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The Year's Progress

Continuing a practice instituted by this journal long ago, the first issue of the year presents again a series of editorial reviews on the progress made in the electrical industry during the twelve months just passed. Prepared as they have been by leaders in the many and diversified branches of the industry, these reviews comprise a summary of progress and achievement which could be secured in no other way and form a permanent record of inestimable value. Most impressive of all this marvelous array of accomplishments in the industrial world is the great overlying result that the applications of electrical energy in our complex modern civilization are second to no other physical agency in rendering useful service to mankind and increasing the sum total of happiness and wealth. And the end is not yet, nor can any man see the end, for the fields of scientific knowledge continue to unfold and expand before us, without limit except our own ability to follow. After pausing to take inventory of the achievements which have just passed into history and gathering to ourselves the lessons which come from healthy retrospection, let us turn to the new year and the future with new zest and enthusiasm for even greater things!

Minimum Wage for Women

Much public commendation has been earned by the Public Service Corporation of New Jersey as the result of its announcement that with the new year it establishes a minimum wage scale of $9 per week for women employees. While the major part of the female help required by a utility company must possess a degree of training and skill which insures compensation well above the low scales paid in other industries, the step of the New Jersey company nevertheless points another application of those broad humane principles which are making themselves felt throughout the business dealings of modern public-service corporations. The effect of the announcement on public sentiment in the community is also not to be lightly estimated, and there can be no doubt that viewed alone as a simple business proposition, resting on the same practical basis on which modern industry places its justification of welfare work, a utility corporation will not lose dollars and cents by adopting such a splendid humane measure. This instance of the Public Service Corporation is an example in point, for the announcement has already struck a popular chord and has been spread by the press throughout all the communities where the company furnishes lighting and railway service. As noted in our announcement of Dec. 28, 300 of the company's 10,000 employees are women. The admirable and altruistic motives which impelled President Thomas N. McCarter and his directors to act promptly on the results of their investigation and set a livable scale for women workers deserve the sincere appreciation of all who have the kindlier outlook on human responsibilities. For those administrators who hesitate to mix business and sentiment it may be of interest to study even the practical advantages that are sure to result from this as from any other broad humanitarian policy which is sound because it is simple justice.

Central-Station Consolidation

One of the comments that have come to us on the discussion of central-station consolidation in our issue for Dec. 28 points out an omission in the enumeration of the faults or possible weaknesses of the holding company. This, one authority on the subject believes, is that a strong and prosperous subsidiary company may be in such a position, as the result of its control by a holding company, that it cannot raise money except through the latter. And if, as may be the case, the holding company is not in a position to get capital on attractive terms or is using for other purposes all the money it can obtain, a given subsidiary may suffer. This is an apt comment. It emphasizes the need for discrimination between holding companies good and bad, strong and weak, and it is something for the owners of independent plants to consider along with the more alluring aspects of being "absorbed." The prosperous company whose earnings go into its own treasury and whose credit can be used at all times for its own benefit can view without envy the position of the property whose resources are at the disposal of the weakly set up or badly managed syndicate.

Electricity in Mail Handling

In the new United States Post Office building erected over the terminal yards of the Pennsylvania Railroad in New York City use is made of electricity for the handling of mail to an extent not previously attempted either in this country or abroad. The demand for speed without confusion in delivering the mail matter just where wanted, combined with the limits imposed by the movement of trains through the sub-basement of the building, rendered the problem of the engineers very difficult and necessitated the designing of special equipment for each task to be performed. The first instalment of an article by Messrs. L. B. Marks and J. E. Woodwell relating to the lighting installation, mail-handling equipment and other features of the undertaking appears in this issue. While many of the design details are more strictly mechanical than electrical, yet all of the motive power is derived from electrical sources and the plans adopted have been rendered possible largely by reason of the flexibility in mechanical performance and convenience in control of the electric motor. The installation

in the New York terminal Post Office represents one of the most interesting and important modern applications of electricity in mechanical service.

The City as a Partner

One of the very interesting tendencies in Continental central-station development is described by Dr. Richard Passow in an important recent paper abstracted in our *Digest* this week. It is not necessary here to go into the details of the various plans for common ownership for electric service which have been carried out in Germany, but the fact that such plans have proved successful is a very important matter from the standpoint of applied civics. In America the line has been very sharply drawn as between private and municipal plants, as though company and city had radically different interests which could not be reconciled by any kind of mutual agreement. In Germany municipal electric plants are as commonplace as municipal water plants are here. A German business man may criticise the administration of his municipal electric supply works, but that it is a thing to be averted at any cost does not enter his mind. On the other hand, Germany has well administered and successful privately owned plants, so it does not stand committed to municipal ownership, however frequently it may be practised.

The system of common ownership described by Dr. Passow, including central stations and electric railways, opens a new phase of the municipal ownership matter. It practically amounts to the city going into partnership with private companies for the development of electrical distribution and transportation, in an attempt to secure the joint advantages of private and municipal control, the former in enterprising and efficient management, the latter in stability and that well-ordered control which it has been found only too difficult to reach by means of commissions and the like. In many cases, a number of which are cited in the paper before us, a single city has an absolute majority control of the enterprise. In other cases a group of cities may together hold control, and in still others municipalities are only minority stockholders. Even in this case, of course, the city as a governing body can exercise more efficient control in holding a formidable minority of stock than it could without it. Such partnership seems to be of service in raising capital on the one hand and in affording a keen incentive for economical and careful management on the other.

German practice as recounted by Dr. Passow shows great variety in the relations existing between the two chief parties to the enterprise. But the main thing is that they seem to work together with a reasonable degree of harmony and the city gets continuing benefit from its own growth, a lack of which is one of the weakest points in the usual plan of giving over a city to exploitation by a private company, which, while generally well disposed and usually under some manner of control, yet gathers to itself most of the benefits which come from municipal growth. With mixed ownership the city obtains its share and is likely thereafter to take a more judicious and reasonable view of the economic situation than it otherwise would. Someone should make a careful study of the situation with respect to such plants in Germany with a view to ascertaining, not the obvious things, but the possible difficulties and the sources of friction which have been found in practice to interfere with the working of a plan otherwise attractive.

Experiments with Umbrella Antenna

The article published on page 47 of this issue, giving the results of a series of tests on radio-transmission efficiencies, is not only intrinsically very interesting but is worthy of especial attention in connection with the measurements recently furnished by Prof. C. A. Culver. In the present paper Mr. Joseph O. Mauborgne reports in some detail, and with excellently stated quantitative data, a group of experiments upon a small umbrella transmitting antenna having a counterpoise earth. It is pointed out that the four radial wires near the ground, but insulated from it, do not form a true "counterpoise" or balancing capacity image of the aerial system, but, rather, are the upper armature system of a condenser in which the earth itself is the lower half. In this connection it is perhaps worthy of note that nearly all present-day counterpoise grounds are in effect capacity earths, since their height above the earth is usually negligible as compared to their lateral dimensions or to the wave-lengths with which they are used.

The exact reason for a 17 per cent gain in efficiency merely through a 45-deg. angular displacement of the earth wires is somewhat puzzling, but perhaps may best be explained by considering that a highly conducting earth path for the sliding wave-feet is provided at points where, in order to reach it, there need be only slight wave-front distortion. The increase of received energy, as measured by the galvanometer, when eight shorter wires were substituted for the four 85-ft. conductors might be expected, if only from the reduction of resistance and consequent lowering of heat losses at the transmitter.

Mr. Mauborgne's figures concerning the change of efficiency due to alteration of the height of the outer ends of the radial antenna wires are of especial practical value. In the normal case the effective height of the antenna was 29 ft. When this was increased by 38 per cent. to 45 ft., the received signal increased to about 140 per cent the original strength. When it was reduced by 27 per cent. to 21 ft., the signals remained nearly constant, falling off only 6 per cent. This result is not in agreement with earlier work carried through on much higher antennas, but it is really not to be expected that the same laws of radiation efficiency would hold when wires are close to the earth and when they are raised well above it. The safe conclusion would appear to be that, even with the outer ends of the antenna wires in their normal position, 18 ft. above the ground, they are too low for good results—a deduction which is strongly supported by the observed fact that a given percentage change in effective height causes a far greater variation in efficiency in the positive than in the negative direction. It is hoped that many additional data of this kind will be forthcoming, since it is through comparison of many experimental results that there will be reached a final understanding of the phenomena involved in radiation from wires.

Electrical Industrial Growth in 1912

By T. C. Martin

IT may be doubted whether many years can be cited as more active in electrical development than was 1912. It was certainly much better than 1911, and back of that lay the dreary stretch of years beginning with the spectacular troubles of 1907. How great the improvement has been no one can tell exactly. In these days of governmental control and supervision, data and statistics become increasingly available, but with the greatest willingness and the best effort applied, they still must be quite a little behind the times. Obsolescence bears more heavily, perhaps, on statistics than on apparatus; and nothing can be so dangerous to the man who would shape his course by them as outgrown and outworn figures in relation to such an industry as electricity. For the four great divisions of electrical application in America—manufacturing, communication, traction, lighting and power—the most authentic data are those of the Census Office of 1905-6-7, but these, as required by the census act, will not be taken again until next year; so that in trying to arrive at some definite result, in setting down the actual expansion in dollars and cents, a good deal of guesswork is inevitable. But there are many bases of calculation. Some companies and systems in each of the fields make regular reports, and through lean years and fat ones electricity makes a steady gain over its entire area of operation that approximates 20 per cent. No one supposes that such a rate can be maintained, but nobody has yet found the point of "saturation" in electrical industries. We are sanguine enough to hope and believe it never will be found.

Coming to the latest possible statistics derivable, we may here set them down in a table, as has been done in these pages for many years past, and with the general pleasing fact that almost every time the new census figures, on coming out, have more than substantiated them.

It would thus appear that the amount paid by the American public for its electrical apparatus and service during 1912 was a little in excess of $2,000,000,000. The actual amount was undoubtedly somewhere in that neighborhood and may easily have reached the estimate given in the second column. The activity of the electrical manufacturers is well known, and the product of only three of the leading concerns if deducted from the total would leave an absurdly small amount for the 800 other concerns. In the traction field the reports of largely increased earnings have been practically universal throughout the year. In New York the subway has been breaking all records day by day. The central-station field has been busy beyond precedent, and most systems exceeded their Christmas peaks weeks ago. In telephony the Bell system alone reached $180,000,000 in 1911, and this year up to August ran to $130,000,000. In telegraphy the Western Union increased its gross $6,000,000 up to nearly $42,000,000. As to the miscellaneous class, everybody is familiar with the gigantic expansion going on in electric vehicles, electric heating and cooking, electrochemistry, electrometallurgy and other branches, all running into their millions of output.

DATA ON ELECTRICAL INDUSTRIAL GROWTH

	1911	1912
Electrical apparatus made	$325,000,000	$350,000,000
Electric-railway earnings	575,000,000	625,000,000
Central-station earnings	375,000,000	450,000,000
Telephone earnings	310,000,000	350,000,000
Telegraph earnings	75,000,000	85,000,000
Isolated plant service	125,000,000	125,000,000
Miscellaneous electric service	100,000,000	125,000,000
	$1,885,000,000	$2,110,000,000

The total increase estimated over the whole area of industry for which this journal speaks is about 15 per cent, and there is no known reason why such an assumption is not safe and conservative. And if such figures be correct, if such estimates be reasonable, what a fund of encouragement is in them as to the present, and what a stimulus to enthusiasm in attacking the vast opportunities of the immediate future!

Progress of Electrical Science in 1912

By A. E. Kennelly

THE year which has passed has not been characterized by salient novelties in the applied science of electromagnetism, but has witnessed noteworthy progress in the developments of various branches of that science. These developments have been especially manifested in the increasing range, extent and control of electrical energy transmission for lighting, industrial service and communication of ideas. In regard to energy transmission, the Au Sable River power plant in Michigan, described in the *Electrical World* of April 13, 1912, has carried the range of three-phase transmission-line emf to 140 kilovolts at the generating end. Such working voltages call for and entail development of the sciences and arts of insulation and current-breaking, not only along the lines but also in the terminal apparatus of the stations connected.

The study of high-voltage insulation in air and other gases leads to, and properly includes, the study of coronal discharge and coronal losses. Very considerable progress has been reported during the year in this direction from the theoretical, experimental and applicational standpoints.

The year has also seen a notable activity in the extension and development of large hydroelectric plants, as well as a tendency toward the consolidation of previously existing plants.

Any notice of development in energy-transmission range would be incomplete, if attention were paid solely to long-distance transmission. The past year will be signalized in history as witnessing the application of electrical science to the transmission of energy at relatively large rate over the minimum distance, of engine-room dimensions, in electrical ship propulsion. The United States collier *Jupiter* launched on Aug. 24, 1912, is the first large ship to be propelled by electric motor. The *Jupiter* is not a steamship in the ordinary sense of that term, but floats in a class by herself and might be described as a steam-electric ship. Practical experience with this type of vessel must remain a matter for the comment of another year.

The disastrous loss of the steamship *Titanic* in April had the effect of directing universal attention to the protective possibilities of duly organized marine wireless telegraphy,

since the boats containing some 700 survivors were speedily picked up in midocean, with the aid of wireless distress signals, while it might have been possible for the entire ship's company to have been saved if a continuous wireless lookout had been organized on all ships in the vicinity. As a result of the disaster, much study and impetus have been given to the subject of radio-telegraphy scientifically, practically and legislatively. An engineering working theory of the average range and capability of radio-telegraphic antennas, although by no means satisfactorily completed, already exists, and much activity has been displayed during the year in erecting long-range wireless stations over the world by the principal industrial nations.

The international radio-telegraphic congress at London last June was a notable event, not merely from the international, legal, commercial or sociological aspect but also from the electrical-science standpoint. The convention arrived at by the Congress, and signed on July 5 by the delegates of thirty countries, is virtually a treaty for the keeping of the ethereal peace. The service regulations appended to the convention constitute the scientific text of this treaty. While not of a highly technical character it is a characteristic of the age that electromagnetic waves should be the subject matter of this international agreement in 1912.

In regard to the wonderful science of electromagnetic metrology as conducted internationally among the various national laboratories of the industrial nations, whereby the ohm, volt, watt and other engineering units are maintained industrially, noteworthy progress has been made in the electrochemistry of the electrolytic apparatus for determining the international ampere. A considerable share of this work has been done at the United States Bureau of Standards. The work of the national laboratories, taken collectively, constitutes a steadily increasing share of the applied science research of the world.

In telephony the year 1912 has been signalized by the laying of a continuously loaded submarine four-conductor telephone cable across the English Channel, between Abbotscliff and Cape Gris-Nez, which supplements the previously existing Pupin-loaded cable across the same straits. Good progress has also been made in the study and scientific analysis of the behavior of telephones and telephonic apparatus.

As illustrative of the co-operation between sciences rendered necessary by the progress of engineering, the past year is notable for the report of the Commission on Resuscitation from Electric Shock, composed of delegates from medical and engineering organizations. The report, delivered at the Seattle convention of the National Electric Light Association, institutes a marked advance over the resuscitation procedure which had been generally followed up to that date.

Although no plenary meeting of the International Electrotechnical Commission was held during the year, yet very effective international sub-committee meetings were held at Paris in April. Good progress was reported from these sub-committees to the respective national committees in the directions of international nomenclature, symbols and the rating of machinery.

Professional ethics may be regarded as a subject lying outside of the range of electrical science. Nevertheless the progress of applied science in electricity is necessarily closely bound up with the growth and development of the electrical-engineering profession, while the recognition of a profession is in its turn closely connected with the recognized standard of its internal ethical relations. The past year has witnessed the first promulgation of a code of ethics by the American Institute of Electrical Engineers. This code presages much for the future of the profession, in so far as it signifies that an internal ethical relation is recognized as existing on a higher plane than that of promiscuous good citizenship.

In electromagnetics good progress has been witnessed in the realization of the electronic theory. The determination of the absolute value of the electronic charge, or quantity of electricity associated with any single electron, has advanced in precision. Moreover, the experiment displayed at the London convention of the Royal Society in June, which actually visualizes the paths in air of the alpha particles projected from a small mass of radium salt, has brought home to the senses the actions of these ultramicroscopic but enormously swift projectiles, in a most convincing manner.

In engineering mathematics good advance has been made in Bessel functions, hyperbolic functions and theta functions toward the solution of some of the numerous problems that confront the electrical engineer. The *Proceedings* of the international mathematical congress at Cambridge, England, contained some important papers on subjects coming into touch with applied electromagnetics.

The Patent Situation

By W. D. Weaver

THE recent public awakening to the need of patent reform appears to be due not to any particular interest in the inventor or even in the righteous administration of the patent monopoly, but to the relation that monopoly has been discovered to bear to the great political issue of the present period—the subjection to proper control of great combinations of capital. The perversion of the patent monopoly has, in interested circles, been notorious for years, but even the eloquent outburst of indignation of Chief Justice White against the majority opinion in the Dick case would perhaps have had no effect on the public at large in the absence of a bearing on the great question of the day. There is a danger in this situation to those interested in patent reform as affecting the inventor and the progress of the useful arts; for with public attention concentrated only on what has become a political aspect of the question, the wrongs of the inventor may pass unrighted and no attempt be made to relieve the patent system from more than a portion of the crushing burden of judge-made law that so largely nullifies the plain intent of the constitutional clause providing for the reward of actual inventors and the advancement of the useful arts. That fear on this subject is not unfounded is indicated by the differences between the amended and the original Oldfield patent reform bill, the present bill omitting all provisions having the specific purpose to remove some of the most glaring abuses of Patent Office procedure. This omission in itself points to the desirability of separating the several issues involved in patent reform that each may receive the fullest consideration on its merits.

The first of these in general importance is the relation of the patent monopoly to great combinations of capital with respect to restraint of trade, to destructive warfare under the patent banner on the small manufacturer, and to the exaction for patented articles of prices that bear no relation to the reward of the inventor and little to the cost of manufacture and distribution. This part of the subject has become a national question, which will be discussed more as a matter of public policy than of general patent reform, and which will finally receive some answer dictated

by the people at large. Those more immediately interested in the rights of the inventor and in the untrammeled progress of the useful arts cannot expect to have an influence in the determination of the great issue much beyond that of any citizen, and therefore might well reserve their forces for combination in advancing directly those objects which without them will have no natural champions. It is true that the gentlemen of the legal fraternity always come to the front with offers of championship whenever redress of inventors' grievances is under consideration; but the wisdom is doubtful of allowing this element any prominent part in councils where measures of relief are planned or in the conduct of campaigns for securing justice. While the body of patent attorneys and lawyers contains unquestionably at least as large a proportion of highly honorable men as any of the other professions, common prudence would seem to dictate that sight must not be lost of the fact that the active agent in connection with practically every abuse of the patent monopoly, whether in the Patent Office or in the courts, has been a patent attorney or lawyer, and that every law or rule which decreases the expense of Patent Office procedure or court litigation will correspondingly reduce their professional revenues.

The other issues above referred to relate more particularly to the manner in which the plain intent of the patent constitutional provision has been perverted to the direct injury of the inventor and to the practical nullification of its expressed purpose to promote the progress of the useful arts. It should be explained in passing that the word "inventor" as herein employed refers to the kind of inventors who actually invent, and does not include those whose salaried work consists in writing patent applications to cover improvements incident to the normal development of an art, nor that class whose inventive faculty is limited to great skill in drawing up specifications and involved claims ingeniously formulated to conform technically to Patent Office criteria of invention as fixed by court decisions, but which in fact are merely speculative anticipations of what some day a real inventor may make an actuality—and then be deprived of the fruits of his labors. The patent constitutional provision—and on this alone rests our entire present patent system—reads as follows: "Congress shall have power to promote the progress of science and useful arts by securing, for limited times, to authors and inventors the exclusive rights to their respective writings and discoveries" (Art. I, Sect. 8). The influence of modern industrial development has practically substituted the manufacturer for the "inventor" as the beneficiary, and judges have so construed the term "exclusive rights" as to establish a monopoly unrestricted by considerations of public policy or of gross injustice to others engaged in forwarding the progress of the useful arts. The justification of this construction can only be on the strictly utilitarian ground that evils which it sanctions are overbalanced by benefits to inventors serving to incite them to the exercise of their inventive faculty to a high degree. In point of fact, the stated object of the constitutional provision is today practically a dead letter, both with respect to promoting progress of the arts and to encouraging inventors. This deplorable condition has been brought about primarily by court constructions of the patent monopoly which have largely transferred its benefits from the inventor to manufacturing combinations controlling an industry; and secondarily, by the growth of great abuses in the administration of existing patent law, which have placed the independent inventor at a hopeless disadvantage in securing his rights in the Patent Office or in maintaining them in the courts. It is the correction of these evils which should receive the support, both individual and organized, of those specially interested in inventions and in the untrammeled progress of the useful arts.

Of specific proposals for remedying in a measure the existing evils of the patent system, two are embodied in bills now before Congress. One of these, introduced by Representative Oldfield, chairman of the House patent committee, relates directly to patent reform, and the other, introduced by Representative Sulzer, Governor-elect of New York State, provides for the creation of a patent court of appeals. Assuming that the Sulzer bill is not subject to future misconstruction in a manner unsuspected by its official sponsor and the numerous public bodies that have indorsed it, the measure should receive the hearty support of all friends of patent reform and have their active aid in procuring its passage at the close of the present session of Congress. The qualification relates to a matter that could be readily cleared up, namely the presence of a clause requiring every case determined by the Court of Appeals to be remanded to the court whence it came for further proceedings taken in pursuance of such determination; which requirement, if not merely of an administrative bearing, might add still another stage of delay and bill of expense to patent litigation. Entirely aside from the special competence, after a time, of such a tribunal to consider patent cases, and aside also from the practical finality of its decisions and from the anticipated reduction in expense of patent litigation, the Sulzer measure should have a far-reaching effect through confining so far as possible the interpretation of the patent monopoly to one judicial body and, of even more importance, through the great facility with which legislation could be formulated and brought to bear if this interpretation at any time should be thought not in accordance with the intent of the constitutional provision establishing the monopoly.

The Oldfield bill represents the long and disinterested thought of able men, instructed in numerous patent hearings which, as reported in printed form, cover almost 1000 pages and reflect the opinion of practically every class specially interested in the patent system. The bill also represents, at least in part, the result of the experience with and observation of patent abuse by the United States Patent Office, and also of unofficial contact by those who drew the bill with the minds of many men who can speak with weight on its subject matter. Its provisions are therefore worthy of the highest respect, but owing to their radical nature, it seems doubtful if the opinion of even the most disinterested friends of patent reform is predominantly in favor of the passage of the bill at the present session of Congress. Should it fail of passage, the situation after March 4 will be ideal for the appointment of a commission similar to that recommended by the Inventors' League and the American Institute of Electrical Engineers for further study of the subject and the report, in full or in outline, of a bill that will place the patent monopoly on a basis in accordance with the constitutional provision which authorizes it. Such a commission might well take for a preliminary basis of consideration the Oldfield bill as representing the political aspect of the patent question and determine in what respect it might be revised. This would, to an extent at least, discourage aimless propositions and render discussion of the whole question more definite. In addition, however, it would be very necessary, should the powers of the commission permit, to report in separate form the basis of a bill relating specifically to the curbing of abuses which otherwise would be transferred from the old to the new system. The original Oldfield bill was largely devoted to such preventive measures, and perhaps it was the part of wisdom to confine the revised bill to the great central principles it was desired to establish.

The substance of bills reported by such a commission might not be satisfactory in very many details, for the result of the deliberations of a body of this kind is apt to be a compromise between contending interests rather than a code of even justice not concerned with the commercial effect of its application. With a commission, however, composed of men of the character proposed by the American Institute of Electrical Engineers, measures recommended

would at least better the present intolerable conditions and be likely to receive favorable action from Congress; whereas, lacking a similar standing with the country at large and with conservative men directly or indirectly affected by its provisions, any bill originating solely in Congress would meet with enormous difficulty in overcoming powerful influences brought to bear to prevent passage, or to permit passage only in emasculated form.

While present indications seem to point to delay in the radical reconstruction of the present discredited patent system, there should be no halt in the endeavor to wipe out at the earliest possible moment abuses that are now daily working injury and which, even if the Oldfield bill become a law, would have to be the subject of supplementary legislation. The grand strategy of enemies of patent reform has been to impose through their overwhelming influence a Fabian policy on their opponents instead of taking direct issue with them—to work to adjourn all action to the Greek Kalends—and this danger should be guarded against. As to any fear that until the greater issue is disposed of legislation affecting the patent system in any manner is unwise, it is difficult to conceive how any action taken at the present time to correct, say, the evil of "dragnet" Patent Office applications can possibly affect the success of pending or future measures for the revision of the principles of the patent system. It is true that any patent bills introduced at the present session of Congress could not, except under extraordinary circumstances, become law; but such measures would serve to place in definite form on prominent record crying specific needs of immediate redress, and thus would have extremely greater weight with a future commission than if presented in ordinary form to a body likely to be deluged with such matter, good, bad and indifferent. It would appear to be a wise policy in aid of the cause for any person or groups of persons who have a strong feeling as to an evil flourishing, with the protection of court precedent, under the present administration of the patent system, to seek for means whereby a bill to right the wrong may be presented before Congress. This is particularly applicable to cases which can be established by reference to published court decisions, Patent Office proceedings or recommendations, or "contents of the file wrapper." Many glaring abuses could be established on the basis of these documents alone, and cases thus supported could not be waved aside as merely representing the grievances of inventors whose devices failed by reason of their own lack of merit to receive the recognition that was sought for them.

A still simpler procedure would be to endeavor to secure the introduction of bills based upon the numerous disregarded requests of Commissioners of Patents for authority to suppress abuses which are committed under the cover of statute law or court decisions. It may not be inappropriate to quote here from the record, for illustration, a few of such requests made for legislation but not granted: A law "To prevent applicants from holding their applications in the office awaiting developments of the art by others and thereafter taking out broad patents which cause those who have made independent inventions during the pendency of the application to pay tribute to an applicant who has merely lain in wait for such developments." A law to prevent "applicants and manufacturers who desire to do so to retain applications in the Patent Office for many years and to use the same as a 'dragnet' to scoop in the inventions of others which have been conceived and matured and a business established thereon during the pendency of these applications." A law to protect the past and present practice of preserving all applications in secrecy, which practice, it appears, is menaced by a decision of Judge Lacombe (thus far disregarded by the Patent Office) that the element of secrecy as fixed by law applies only to applications interfering with caveats—and caveats were abolished by law in 1910. Commenting on the effect of removing the seal of secrecy, the Commissioner of Patents states that "the files of the Patent Office would be continually searched by people who desire to obtain knowledge of others' inventions for the purpose of interferences and otherwise, and it would lead to the appropriation by unscrupulous parties of inventions made by others."

Numerous other abuses flourishing under the protection of law surely excuse impatience over any further continuance of the invariable practice of the past to defer to the indefinite future action on definite patent evils calling for immediate correction. Naturally a preferable way to attack the class of abuses referred to specifically above would be in a systematic manner and more or less completely, through the agency of organized bodies representing the technical arts, and it would be most desirable to secure such support. Lacking this, however, or while awaiting it, the independent inventor should join every force he can command in the battle which, after decades of apparently hopeless waiting on his part, is now opening with his grievances as one of the war cries.

The Water-Power Situation

By Louis Bell

DURING the past year the complex problems relating to the water-powers on the public domain or otherwise within public control have been the subject of considerable discussion, mostly fruitless, although not wholly without avail. None of the proposals for federal control has met all the reasonable objections that could be urged against it, and the situation as a whole is still in a turmoil. The discussion late in November in which the State of California and the Pacific Coast interests were concerned came nearer to being a frank consideration of the situation than anything which has yet occurred.

There have been a good many scare-head lines announcing and denouncing the existence of a so-called water-power trust. Those best acquainted with the situation take the view that there is no such thing as a water-power trust, but that if the hydraulic interests of the country slip out of the intimate control of the federal government or of the states the consummation of a water-power trust is a thing reasonably to be expected. At present the situation is merely that certain large groups of interests have been quick to appreciate the value of hydraulic privileges and active in investing in them. Anybody who has the money can buy and develop a water-power quite unhindered by any aggregation of capital thus far disclosed, but if he proposes to borrow a large amount of capital to carry out the development he naturally goes to one of the groups known to be willing to invest in such property and to take an active interest in the subject. In this way has originated the control of a large amount of water-power by a comparatively small number of interests. There is no menace to the general rights of the public in this, and in point of fact it has over and over again been shown that whenever the hydraulic resources of a considerable territory can be physically merged into unified control they become more valuable to the community than if operated independently. The only thing from which the community rightly desires protection is an era of extortionate prices brought about by improper use of the monopoly thus obtained.

The problem for the general government to undertake with respect to the unutilized hydraulic powers within its sphere of influence is merely to control these valuable privileges in the interests of the general public to the best advantage. This condition is certainly not met by setting up regulations which will discourage the utilization of these powers. The potential annual value of hydraulic privileges now unutilized and wastefully pouring their water seaward is to be reckoned in hundreds of millions of dollars per annum. It is sheer continuing waste for which the world gets no kind of recompense. Granting that the government under reasonable conditions should permit and encourage the use of the water-powers it controls, the next question which arises and which has been a constant subject of indeterminate discussion is whether the control suitable to what one may properly classify as a natural monopoly should lie with the general government or with the states. In theory, local control, like local self-government, has much to recommend it. In practice, state control of very many things now regulated thereby turns out to be extremely unsatisfactory. Questions are constantly arising in matters of great importance to the country at large, in respect to which conflicting policies are in force in various states, to the utter confusion of good government. With the more general development of water-powers interstate complications of a very embarrassing character are certain to arise if unrestricted control is left to the state. For example, the very serious question comes up as to whether a state may prohibit the export of hydraulically generated energy or may levy a tax upon its export. Many power companies are constantly doing an interstate business, and if conflicting interests of any kind result in a conflicting policy, a perfectly sound enterprise doing business with energy derived from the public domain may find itself in all sorts of trouble. For this reason the trend of what the writer believes to be the sounder opinion turns toward effective government control.

To preserve the equity of the people as a whole in these powers some provision must be made for close, effective and continuing regulation, including regulation of prices. The projects for regulation now in force or on foot are open to criticism because of their establishment of a rental basis. The ultimate result of this must of necessity be an increase of the price to the consumer, as was pointed out in the recent conference at Washington—an increase which in some cases might rise to a very substantial amount. It would seem to be more in line with the policy of ultimate public usefulness to charge no rentals, or at least no more than a nominal sum to cover the expenses of supervision, and to adopt such regulations of the activities of the plants concerned as will keep the price of their product down to the irreducible minimum consistent with a suitable return on the capital actually invested; and as a mere matter of decent fairness this return, considering the laborious and uncertain nature of the development especially in its early stages, ought to be a liberal one. The main thing for which the government must look out is that whatever this fair return may be, it should not be permitted to increase by methods of indirection only too well known in the history of public-utility enterprises of various sorts. This is the same question that arises in the case of the work of the ordinary public utility commission and which in general is rather badly bungled. An allowance of profit apparently fair and conservative in case of a plant built for cash and operated for profit becomes extortionate when the same percentage is reckoned on a plant built via an elaborate chain of promotion and underwriting, very likely through a construction company and an operating company, with a subsequent line of consolidations and extensions. When a process such as this has been gone through one has to peel off successive allied, associated and affiliated corporations like the successive skins of an onion before reaching the core which represents hard dollars invested in the enterprise.

The time of wild-cat exploitation in power enterprises should be considered as long past. If properly planned, they are sound, sane, conservative investments entitled to be treated as such. If the government would bend its energies toward getting the available powers promptly and effectively utilized and protecting the public by rigorous supervision of the financing and operating involved in this utilization, it would do far more to benefit the ultimate consumer than it can do by hanging back, hesitating, and taking out in rentals the surplus that ought to be applied to reducing rates. The legal aspects of the question are intricate and ample precedents are to be found for almost any point of view which has been taken in the matter. It ought to be comparatively easy, however, to secure through Congress legislation by which, when a public power site is taken up, it should be by the very terms of its lease under full and direct control by the properly constituted department of the general government. This accomplished, there need be no fear of a hypothetical water-power trust or of injustice being done to the public by the lessees of public water-powers. It is to be earnestly hoped that the final straightening out of the difficulties of this particular situation will be undertaken by the new administration at an early date and carried to a conclusion, so that we may no longer have to see, so to speak, a golden stream pouring down our watercourses into an abyss from which it can never be recovered.

Developments in Prime Movers

By W. F. Durand

THE past year has witnessed little of revolutionary character in prime movers so far as concerns the field of central-station practice. There has been, none the less, steady advance along lines marked out by characteristics noted in these columns during the past years and indicating a consistent and continuous development in accordance with well-settled principles. It may not be too much to say, so long as we are to deal with the present balance in the matter of cost and character of fuels, efficiency, reliability and adaptability of the various forms of prime movers, that progress and development will be concerned with matters of detail along present lines rather than with deep and radical changes. This means no more than that during the past decade, to go no farther back, the design of central power stations has become more and more perfectly adapted to the existing balance, as referred to above, and a typical design of the present day represents within the limits imposed by this balance and by our present scientific knowledge a very refined solution of the problem of the economical development of power from natural sources of heat energy. This does not imply that changes and improvements, possibly profound in character, will not come, but they will be the outgrowth of changes in the balance as noted above, or of the discovery of new laws, or of some combination of such causes.

Referring briefly to fuels, coal and oil retain substantiall the same relation as in previous years. The question o' choice is simply economic. The general program for the effective combustion of both types of fuel and for the economic use of the heat liberated is now well understood. Matters of improvement relate to details. Thus in general there seems to be a well-marked increase in the use of

carbon dioxide indicators or recorders. This shows a growing appreciation of the necessity of stopping wastes, especially those unseen or unrecognizable by ordinary means, and of the aid which the CO_2 recorder may yield in this respect. It may not be amiss, in this connection, to warn against blind dependence on such indications alone. The waste heat escaping by way of the stack depends on both the quantity of the gaseous products and the stack temperature. The CO_2 recorder gives indications regarding only the first of these two main factors. The stack thermometer must be used as carefully and its indications studied as critically as are those of the CO_2 recorder.

In the matter of fuel oil combustion, some continued progress is noticeable in the extension of mechanical methods of atomization as a substitute for atomization by means of steam or compressed air. The use of steam entails a tax required for atomization usually of 3 to 4 per cent of all the steam generated by the boiler. With mechanical atomization, including steam condensed in high-pressure heaters, this tax can be reduced to about 1 per cent. Recent extended tests in California on this matter have clearly established the high economy of atomization as such when carried out by suitable mechanical means. Such tests, however, have not always shown as good gross boiler efficiency as with steam atomization, so that the final net economy is not far different in the two cases, though usually with some advantage for mechanical atomization. The next steps would appear to involve a more careful study and adaptation of furnace forms, proportions and air inlet arrangements adapted as perfectly to the mechanical atomizing burner as present forms are to steam atomization. A further requirement is indicated in the need for flat or fishtail flames rather than divergent conical flames. The latter form, naturally given by several types of mechanical burners, is harder on tubes, requires greater furnace height and is not well adapted to the usual type of central-station boiler. With these details in hand, it seems reasonable to look for continued extension in the use of mechanically atomizing burners.

Turbines and Reciprocating Engines

The competition between steam-turbine and reciprocating engines as prime movers for large units is a thing of the past. The turbine alone is considered the normal type and a reciprocating steam engine for a large unit would now be an absolute anomaly. In the field of small units and for auxiliary equipment the reciprocating type still holds its own, though even here the turbine is making rapid and notable gains. Alternating-current units in decreasing sizes are offered with turbine drive; gear reduction provides similar drive for direct-current units, while pumps and blowers of various designs are now offered with turbine drive. Many of the special forms of turbine developed for small units or for auxiliary drive show good economy and are giving excellent satisfaction. The reciprocating engine in ratings up to 200 hp or 300 hp, however, shows such marked thermal superiority over the turbine that in cases where economy is of controlling significance the reciprocating type must still have the preference. This superiority may be still more definitely assured in engines using superheated steam and units designed to operate on the "inflow" principle.

The trend of development in steam-turbine practice during recent years has taken on a most interesting and significant phase. Whereas in earlier years the line of separation between the various types was very strictly drawn, especially between the so-called impulse type with fixed nozzles and the reaction type with nozzle effect in the space between the moving blades, in more recent years there has been a gradual coalescence of types until we now find Curtis turbine types with reaction stages in addition to the normal fixed nozzles and velocity stages, and also Parsons turbine types with fixed nozzles in addition to the normal reaction effect. In general it has been found that each type has its special advantages and troubles, and it is only to be expected that the best possible turbine will show features of both fundamental types. In particular it has been found with the Parsons type that the high-pressure end is relatively less efficient than the low-pressure end and that fixed nozzles and an impulse effect may be used with advantage in this part of the program. Similarly it has been found that a reaction effect may with good effect be introduced in the later stages of a Curtis type machine. In this manner design is becoming eclectic, freely choosing the best features from the whole field of turbine practice. A further feature of interest is found in the continued development of Curtis turbines in the horizontal form. At the present time this form is built in all sizes except the largest, and it yet remains to be determined whether the vertical form will be permanently retained for such or will gradually be displaced by the horizontal form for all sizes.

Among reciprocating types of steam prime movers the development of the Stumpf "uniflow" engine has been the most significant in recent years. During the past year the Nordberg company, which has undertaken the construction of the engine in this country, has made extended investigations on an experimental engine, with gratifying results both as to economy and overload range. By reducing the effect of cylinder condensation to a small part of its normal value in the single cylinder type, the uniflow engine realizes the economy of the compound type without its complication in construction.

Superheated Steam

Developments generally in the use of superheated steam are slow but steady. In the field of large central power stations the almost universal use of the steam turbine with its ready and effective utilization of superheated steam has forced upon boiler manufacturers the necessity of reliable and effective superheating boilers. This demand has been met and there is now on the market a wide variety of superheating boilers, safe, reliable and effective in operation and suited to any engineering demand. So far as the provision of superheated steam is involved, the problem is well in hand, and it remains to extend the field of its use in the prime mover. Following the example set by European engineers we should look for a continued, even if gradual, extension in the use of superheated steam with reciprocating engines as well as in turbines.

Certain experimental work carried on during the year brings into prominence the fact that a steam pipe carrying superheated steam may also carry moist steam or even slugs of water along as well. The water present will not, of course, be in thermal equilibrium, but will be in the process of vaporization. This, however, is a process requiring time, and with the high speeds of steam flow commonly employed it may be quite possible for a slug of water to pass through the superheater and along the steam pipe to the engine. These observations indicate that due precautions regarding water must not be relaxed even with superheated steam equipment.

A remarkable investigation by Armand Duchesne at the University of Liège reported during the year by Dwelshauvers Déry seems to call in question the large amount of work done recently in connection with the determination of the physical properties of superheated steam. Mr. Duchesne has found a marked discrepancy between the temperature of superheated steam as indicated by a mercury thermometer and by a very sensitive thermocouple which he has devised and employed in a long series of studies in this field. If further examination should serve to verify these observations, a new set of steam tables will be called for so far as the superheated field is concerned. The further examination of the points raised by Mr. Duchesne will be awaited with the keenest interest by the engineering and scientific world.

Internal Combustion Engines

The development of the internal combustion prime mover in recent years, and especially of the Diesel type, has been nothing short of phenomenal. While most of the growth has taken place in Europe, recent tendencies in the United States indicate a growing interest among engineers in this type of prime mover, and we may anticipate in the near future a very marked extension in its use. At present, however, it must be recognized that the Diesel engine is not a rival of the large steam turbine or adapted for use in large central stations. In large sizes the steam turbine will show the more economical and more satisfactory results, while in small sizes the internal combustion engine in general, and the Diesel engine in particular, will show much the higher efficiency. The two general economy curves will cross at some size of unit variously estimated at 1500 kw, more or less. In any event for small units of 1000 kw or less, and where satisfactory guarantees may be obtained as to the supply of oil, the Diesel engine unit may fairly be said to have won the right to first consideration. When the units are 2000 kw and upward the limit of present size is quickly reached and the indications are still in favor of the steam-driven unit.

Engines of the Diesel type are now guaranteed between full and three-fourths load to give 1 kw-hr. on 0.5 lb. of oil having a heating value of not less than 18,500 heat units or on a heat input of not exceeding 9250 thermal units. Engines of this type, however, are expensive in first cost and require careful and systematic attention in operation. The final determination must include consideration of all elements of annual cost of energy, both fixed and operating, and first appearances may not always be reliable. In general, however, engineers having to deal with small power units will be well advised to investigate carefully the possibilities of engines of the internal combustion type as prime movers in such cases.

Economy and reliability still remain the touchstones of engineering practice and all questions must be resolved in the light of the conclusions derived from the application of these tests.

Developments in Electrical Machinery

By B. A. Behrend

AS it is easier to summarize the past than it is to forecast the future, so it is easier to study evanescent types than to make predictions as to those which will replace them. With the sounding of the death knell of the reciprocating steam engine in large units, the virtual disappearance of large engine-type generators has commenced. It seems pathetic that the labors of the last thirty years, culminating in the development of almost perfect types of slow-speed electric generators, have not been of more permanent value. Their effect has been chiefly instructive, as far as the present types of electric machinery are concerned. The gas engine has not taken the important place which its friends predicted for it half a dozen years ago.

Although statistical figures are not available, it is not unreasonable to assume that the aggregate horse-power of gas engines produced per annum is only a small fraction of the horse-power of steam turbines produced in a corresponding period. The numerous attempts at compounding these generators which used to be made have been altogether given up and, if there is any notable tendency in regard to the regulation of these generators, it is in favor of coarser regulation, rather than finer regulation, leaving the task of keeping the voltage constant to the switchboard operator.

Low-Cost Tendencies

There is a general tendency, noticeable here as elsewhere, aiming at a reduction of cost and, while this tendency is of course natural, it is probably accentuated by the knowledge of the relatively short time during which any particular type of machine has been able to hold its own. Quick succession of types directly tends to a desire to install short-lived machinery of low cost, rather than long-lived machinery of high cost, as new ideas and improvements may lead to obtaining economies and advantages which could not be obtained with the older types. This is really to-day a characteristic of engineering development in all fields. Rapid progress has unsettled our opinions and played havoc with our standards. Quality has to yield to cheapness as permanence is called in question, and the guiding principle of natural selection, leading to the evolution of types no better than necessary to hold their own, finds application here as elsewhere.

We may now turn from this field to another. The energies of the electrical designer have been concentrated upon the development of the high-speed generator for direct connection to steam turbines. The progress achieved in this direction is brought out clearly by the accompanying table, giving the maximum rating obtained for certain speeds during the last eight years.

DATA ON HIGH-SPEED GENERATORS DIRECTLY CONNECTED TO STEAM TURBINES

Year	R.P.M.	Maximum Rating, Kw
1904	3600	400
1909	3600	2,500
1912	3600	5,000
1904	1800	1,500
1909	1800	10,000
1912	1800	20,000

The tendency to push the limit of speed farther and farther and to reduce the cost of the unit and increase its economy of operation seems to have reached a goal. Not only have almost all known special alloys been called into use and taxed to the limit of their strength, but also it seems as if a further increase in speed would increase the losses and thus lead to lower efficiency, while the need of higher grades of material and greater care of workmanship and inspection would enhance the cost of production.

Special Materials

Thanks to the stimulation of the automobile, alloy steels have been produced of an elastic limit of 100,000 lb. per square inch, and of an ultimate strength of 125,000 lb. per square inch, showing a ductility better than that ordinarily obtained in the regular carbon steels, and this even in comparatively large forgings. Although such large forgings, which have to be used extensively for turbo-generators, have been improved from year to year, and although their manufacture is now less of a speciality than it used to be, yet the difficulty of heat treatment and the danger of concealed flaws is such as to make the careful designer prefer the use of rolled materials wherever possible to large steel

forgings. A rolled plate receives a more thorough work through its texture than a forging, insuring greater homogeneity, which is of prime importance. Thus, in the building of turbo-generators, the use of steel plates marks what one might almost be tempted to call an epoch.

Ventilation

It is evident that the great development of heat, due to the concentration of comparatively large losses in single units, represents a formidable problem for the engineer. In a 20,000-kw unit the losses dissipated in heat will reach approximately 400 kw, and this heat is developed in so small a compass that the old methods of carrying it away from the generator are no longer efficacious. It has been found necessary to subdivide the iron and the copper, not only through the regular ventilating ducts, but also through longitudinal ducts through the cores of both the rotor and stator. In fact, the tendency toward the utilization of such axial ducts for carrying off the heat is clearly in evidence. We are passing in these machines from radial ventilation to axial ventilation and, while heretofore powerful fans, mounted on the ends of the generator shafts, were sufficient to pass air currents through the generators to carry off the heat, in the latest units it has become advisable to install separate blowers, which can be operated at speeds more economical than the generator speeds, leading to a greater efficiency on the part of the ventilating mechanism, besides allowing a more scientific design unhampered by the constructive features of the turbo-generator. Future power plants will have large blower plants carrying away the hot air developed by the electric generators, similar to the present installations used for air-blast transformers.

Friction Losses

With the high rotative speeds of turbo-generators there has come as a grave difficulty the great loss due to aerial friction. This loss, usually styled windage loss, has become so great that it constitutes a serious argument against further increase in speed. The gain in efficiency due to the better utilization of steam in the steam turbine must, at a certain point of speed of the generator, be counterbalanced in the increased windage losses of the generator proper. This is a matter of calculation for each size and speed where the efficiency of the steam turbine is accurately known beforehand. There is no doubt that ideas at present seemingly abortive, as, for instance, operating the generators in a vacuum, irresistibly suggest themselves to the designer, and he must remember that here as elsewhere new ideas are the heresies of to-day and the superstitions of to-morrow.

Direct-Current Turbo-Generators

The direct-current turbo-generator has been a will-o'-the-wisp during the past few years. Attempts to adapt the unipolar type to it have not been altogether unsuccessful, and this seems really the best that can be said. More and more we begin to realize that large direct-current units are not necessary, and that they are certainly not desirable. The necessity of distribution of electric energy leads logically to the generation of alternating currents which are transformed into direct current by means of synchronous converters and motor-generator sets. For the time being, we must see the solution of the problem of generating direct current at high rotative speeds in this method of transformation, without considering it at all as final.

Electrical Devices for Automobiles

To sum up, the progress in the development of electrical machinery during the past year has been largely in the refinement of details, and even there it cannot be said that the year 1912 has been remarkable for notable improvements. The attention of the electrical engineer has been directed toward the development of small electrical devices for the automobile industry, as the electric lighting of automobiles, the starting of the gasoline motor and the combination of these two electric devices with the ignition of the gasoline motor. Marked and ingenious work has been done in this field, and, in view of the great commercial and industrial importance which the automobile has assumed, the manufacture of these auxiliary devices for the automobile is the most important event in the electrical industry during the year 1912.

The Distribution of Electrical Energy

By H. B. Gear

THE developments of the year in the distribution of electricity have been made rather in the direction of refinements of detail than in modification of systems. Standard practice has fixed upon the use of three-phase alternating current as the most desirable medium for the general distribution of electricity except in the very congested centers of the larger cities. Direct-current low-tension networks will be continued in those parts of large cities where the load is very dense and the requirements as to continuity of service are such that the expense of storage-battery installations is fully justified. Alternating-current distribution in the form of a secondary network is being adopted more generally each year where the distributing systems in the central portions of medium-sized cities are being put underground. Four-wire, three-phase systems, operating at approximately 115-200 volts, seem to have the predominating advantage in such situations. With this system lighting and motor service may be given for all ordinary retail purposes from the same means, the principal disadvantage being that there are three phases to keep balanced. Wholesale consumers having installations of 50 kw and upward are most advantageously supplied by an installation of transformers made on the premises.

Protection of Circuits

The security of service supplied by networks is still unfortunately dependent on the operation of protective devices which are prone to go into action when no emergency exists and at very inopportune times. A network protector designed to cut out defective transformers without interfering with the service has been developed during the past year, and other improvements will doubtless be made which will minimize these difficulties. The development of secondary networks has been encouraged by the substitution of tungsten lamps for inclosed-arc lamps and by the development of compensated types of induction motors having high power-factors. Every step toward the elimination of inductive loads among retail users brings nearer the possibility of secondary networks operating on the same basis as direct-current networks.

Primary Distribution

In primary distribution 2200-volt, 60-cycle distributing mains are becoming universal. Three-wire delta-connected three-phase systems are quite general in cities having loads of 200 kw to 1000 kw. In the larger cities there is a steady trend toward the four-wire, three-phase

Y-connected system, operating at 2200/3800 volts. This system has very marked advantages where feeders are extended more than 2 miles from the point of supply and where adjacent towns within a radius of 5 miles may be served without step-up transformers or substations. Ability to regulate the phases of a four-wire feeder separately and freedom from the necessity of maintaining a carefully balanced load give this system a flexibility which is being taken advantage of more and more each year.

The four-wire, three-phase system has been very successfully applied to the supply of scattered districts where the distances between towns are as great as 10 miles to 15 miles, by stepping the distributing voltage up to 4400/7600. The various towns connected to the feeder are served by a two-to-one-ratio transformer of 50-kw to 100-kw rating, stepping down to the ordinary distributing voltage. The regulation of these circuits is accomplished entirely at the point of supply, thus eliminating attendance in the various towns supplied and keeping the substation investment down to the cost of an out-door transformer on a platform supported by a few poles.

Increasing Use of Alternating Currents

The use of alternating-current distribution has been encouraged by the development of rectifier equipments and other refinements which have greatly facilitated the charging of electric vehicles from an alternating-current supply. Indeed, the progress being made in the introduction of electric trucks is resulting in the establishment of garages of such size that alternating-current supply may be installed more economically than is possible with direct-current feeders. The advantages of induction motors in many kinds of manufacturing where direct-current commutators are troublesome have led to a demand on the part of some wholesale users for alternating-current supply in direct-current territory, and the tendency for the direct-current system to be gradually extended in response to demands for direct current seems likely to be offset, if not entirely reversed, by the demand for alternating-current service for manufacturing purposes in direct-current territory.

Street-Lighting Systems

Street-lighting systems are being steadily improved by the use of tungsten lamps both in substitution for inclosed alternating-current arc lamps and as an auxiliary to existing arc lighting systems. The tendency at present appears to be toward the introduction of flaming-arc lamps in the central districts where high intensity of illumination is required and tungsten units in outlying districts where a distributed illumination of lower intensity fulfils the requirements. The general introduction of distributed tungsten lighting is, however, retarded by the rather high cost of installing the circuits which are necessary for an ideal location of lighting units. The use of single and multiple conductor, steel-tape cable for tungsten series street-lighting systems has been started with very satisfactory results as to first cost, the cable being laid directly in the parkway without the expense of conduit construction. The adoption of such construction for residence districts will permit the use of underground lighting systems far more generally than would be possible with a draw-in conduit system. It is to be hoped that operating experience will prove that the steel tape is sufficient protection for such cables. The installation of ornamental street-lighting systems by means of iron posts has made immense strides forward. Such systems are being operated on both series and multiple distributing circuits, the series system being used chiefly where the posts are made part of the general street-lighting system. The multiple system is preferred where the post lighting system is maintained separately from the general street-lighting system and is not paid for out of the public funds.

Overhead Construction

In overhead construction methods there is a definite movement toward the improvement of appearance of distributing lines in residence districts. This has led to the use of a neat design of concrete poles where work is done on private property, these poles being utilized for both lighting and telephone service and being limited in height. The use of cross-arms has been eliminated as far as possible, the secondary mains being supported by vertical brackets carried on the side of the pole. Still further improvement has been made in some localities by the use of multiple-conductor wire for service drops. The general trend toward the removal of overhead lines from streets continues, and the use of lines in alleys and on private property where there are no alleys becomes more extensive each year.

Unified Systems

Having survived the vicissitudes of the alternating-current versus direct-current controversy and outgrown the obsolete policy of separate systems for lighting and motor service operating at various odd voltages and frequencies, electrical distribution moves steadily forward toward its ultimate goal of ideal service to all consumers. The ideal system must be one which serves lamps, motors and all energy-consuming devices from the same mains at the same frequency and at as few voltages as distances will permit. It must finally combine the security of the battery-protected direct-current system with the flexibility of alternating-current distribution, and should serve all parts of the system equally well.

Progress in Transmission

By Ralph D. Mershon

THE past year has not been marked by any startling advance in the art of high-voltage power transmission, though there has been that evolutionary progress that might be expected in so active a line of work. A number of high-voltage plants, 100,000 volts or over, some of them of voltages considerably higher than any used heretofore, have been put into commission, and a number of others are in course of construction or have been projected. A considerable number of outdoor high-voltage substations have been put in, both switching and transforming stations. There has been a thorough try-out of a system devised a year or so ago for removing short-circuits or grounds caused on transmission lines by flash-over of the insulators. This is the system which suppresses such disturbances by automatically producing a short-circuit at the generating station and immediately afterward removing it. As shown by practical experience, it effectually removes or suppresses line disturbances of the kind mentioned with practically no interruption to the service of the system.

Increase in Voltage

Transmission voltages are gradually creeping up to higher and higher values. In some cases higher voltages have been used than would seem to be economically necessary. Presumably this is in some measure due to the desire of the engineers having the plants in hand to be in the vanguard of progress. But even though in some cases a lower voltage might, from an economical standpoint, be equally satisfac-

tory with, or even more satisfactory than, the high one adopted, the art of power transmission is undoubtedly indebted to these enterprises and to their engineers for the adoption of the higher voltages, by reason of the aid which such adoption and the carrying out of the enterprises lend to the progress of the art. There is no doubt that so far as our present knowledge goes there is no physical limitation to the transmission voltage which may be employed. The limitation, as with most other matters, is a purely economic one. It is purely a question of cost and the return that can be derived therefrom.

The highest transmission voltage put into practical operation during the last year is 140,000 volts. This is the voltage now regularly employed on the lines of the Au Sable Electric Company in Michigan. The highest projected voltage is 150,000 volts, for which the lines of the Pacific Light & Power Corporation are being constructed. Although the value of voltage, in common with other considerations affecting the transmission line, is usually fixed by economic considerations, there is one element in connection with all transmission lines, whether high voltage or low voltage, not ordinarily considered as being strictly subject to economic limitations alone. This is the matter of interruptions due to lightning. Strictly speaking, this question is also determined by economics. Because if we chose to spend a sufficient amount of money on an installation it would be possible to make it immune to atmospheric disturbances. To do this in the case of a long high-voltage transmission would mean such an enormous first cost as to be entirely prohibitive. So it might be considered, in view of the enormous cost involved, that these costs themselves compel the classing of the problem as a physical one instead of an economic one. That is, it may be considered that such drawbacks as still exist in the art of transmission due to atmospheric disturbances are drawbacks which from practical considerations must necessarily be overcome, not by an enormous increase in first cost, but by some solution having to do more directly with physical conditions—by some solution having mainly to do with the working out of a problem in the arrangement of transmission lines, or the insulation of transmission lines, or both—and which is, therefore, more immediately physical in its nature and does not greatly involve the relation between cost and the result obtained.

Insulation of Line

While this physical problem of procuring for transmission lines practical immunity against atmospheric disturbances involves in some measure the arrangement and disposition of the lines, the present tendency is to consider it more a problem of insulation and its accessories. This is shown in the investigations that are now beginning to be actively taken up with relation to the effect on insulators of such electrostatic stresses as may be met as the result of lightning; in the study that is being made as to the relative effectiveness of insulators when subjected to voltages at ordinary commercial frequencies and to the same voltages at frequencies approximating those which we are led to believe exist in the case of many lightning disturbances.

It has long been known that insulators which would flash over at ordinary frequencies, rather than puncture, are often punctured on a transmission line by lightning disturbances without any evidence of accompanying flash-over. In other words, there seems to be no question that there is some very considerable difference in the condition which exists when an insulator is, on the one hand, subjected to a given voltage at a commercial frequency and when, on the other hand, it is subjected to the same voltage at an enormously greater frequency. Or, to put the matter in a little more exact language, the behavior of insulators when subjected to a difference of potential whose rate of change, or steepness of wave front, approximate those which are met with in commercial work is quite different from the behavior of the same insulator when subjected to a difference of potential whose rate of change is enormously greater than that normally impressed upon the line.

Need of Better Insulators

The results obtained so far seem to point to the possibility of obtaining insulators which will meet that condition usually considered most desirable for enabling them to withstand lightning disturbances; that is, that of always withstanding the tendency to puncture to such an extent as will force the abnormal voltage to flash over the insulator instead of going through it. If this condition of affairs could always be insured, we might have a line practically immune to every condition save that of malicious interference. Because, if we could be sure that the insulator would always flash over and never puncture, it is comparatively easy, at relatively small additional expense, to make such provision as will insure the insulator not being harmed by the power arc following such flash-over.

The direction in which the greatest progress to-day can be made in the art of high-voltage power transmission is that indicated above. Undoubtedly the greatest desideratum at the present time is an insulator which will always flash over, rather than puncture, under any voltage to which it may be subjected, and will not be damaged by a flash-over. As a secondary matter, it is desirable that the power arc following a flash-over will not interrupt the service rendered by the transmission system. But, as previously mentioned, means are now available by which such interruption can be almost entirely insured against. The need, therefore, is only for an insulator which will never puncture and which will not be injured by the power arc following a flash-over during such period of time as may elapse from the time the power arc starts to the end of the very short period of time during which the auxiliary apparatus referred to has had an opportunity to suppress the arc.

Outdoor Installations

The tendency is more and more toward installing high-voltage apparatus outdoors. Undoubtedly the time will come when all high-voltage apparatus whatsoever will be so installed. There is no good reason, either logical or financial, for going to the expense of bringing a high-voltage terminal through the metallic case of a transformer or switch of which it is a part and then going to a similar expense to bring the same terminal out through the wall or roof of the building housing the apparatus. A terminal built to withstand the weather might just as well be put on the metallic tank in the first place and the apparatus placed out of doors, thus saving not only the insulating bushing but practically all of the building as well, since with such an arrangement no protection is necessary save that for switchboard panels and operators.

Operation of Transmission Systems

The tendency at the present time as regards the operation of transmission systems is undoubtedly more and more toward the creation of enormous networks extending over large areas of country, into which is fed energy from a plurality of sources. The desirability of such combinations is unquestionably indicated by all the economic considerations bearing upon this class of work. Such networks not only benefit by the diversity factor of the various customers they supply, but their utility is also strongly indicated by the additional insurance of continuity of service resulting from energy supply from a number of sources instead of from one. We may continue to expect the amalgamation of transmission systems into transmission networks wherever such systems are within economically reachable distances of one another. We may expect in the not distant future such development in the insulation and construction of transmission lines as will guarantee to them practical immunity from any interruption save that due to malicious interference.

Consolidation of Central Stations

By L. H. Conklin

BY far the most notable development in the field of the small central station during the past year has been the rapid—one might say, almost hysterical—haste to purchase the smaller plants by existing or newly organized holding companies. Some of these companies have been operators in name only and owe their excuse for existence solely to the desire of some banking house to manufacture securities of a kind that is finding such a ready sale to the indiscriminating public. But such absorption of small properties into holding companies which really have an efficient operating organization and good financial backing offers, of course, undoubted advantages to the investor and is a great boon to the communities served by the combined companies.

As a consequence of this general movement there is coming about one feature of the evolution which, to old timers at least, is almost pathetic, and that is, the passing of the old-time small-plant manager with the full control and responsibility he enjoyed. His has been a picturesque figure in the past, for on his shoulders rested the responsibility of all problems from the disposal of ashes to the paying of dividends. His duties were those of lineman, engineer, fireman, solicitor, bookkeeper, diplomat, etc. A man who could perform them all fairly well was called a good manager; the man who was an expert in them all did not exist, hence the present tendency toward extreme specialization. These old-time versatile managers, while now only cogs in a big wheel, will nevertheless fill important places in the new era, for past experience has endowed them with judgment and knowledge which will be badly needed. Their superior ability will soon place them on a high level in the final consolidation, and they will contribute a giant's share in solving the new problems of group operation; for the success of any consolidation depends upon the individuals who make up the organization.

Advantages of Consolidation

Disregarding for the moment the unsound consolidations, let us consider the effect of logical and proper grouping of many small plants under one management in a holding company. The more obvious advantages are: more effective results obtained by the division of labor among specialists, resulting in better engineering, cheaper operation, more detailed accounting and more scientific commercial development; a uniform policy under one head; the benefit of comparison and a friendly rivalry in the operation of the separate plants; better attention to legal and corporate affairs, and the ability to get money for extensions and improvements by the sale of a security with a broad and ready market.

Some of the more apparent disadvantages of consolidated operation are the lack of direct personal contact with the public, which is very important; the necessity for more red tape; the natural prejudice of a town against a "foreign" corporation; the chance for "internal" politics, and the delay in getting quick action or decisions on matters where often time is the deciding element. In spite of the gravity of these disadvantages, even a casual comparison will show that they are easily outweighed by the advantages.

Anyone who has visited many small stations must have observed what a tremendous waste poor engineering has caused. The local man probably did his best, but his experience was very limited, and he had no time, or could not afford, to travel about and see what others had done so he depended upon his own judgment, backed up by rosy tales of salesmen who appealed to his egotism or played upon his ignorance. He fortified himself, perhaps, by making a few inquiries from men who probably knew as little or less than he himself. The result, unfortunately, has often been a large and useless expenditure, resulting in a hopeless lack of uniformity. The profits of many electric-light companies are thus buried in their own scrap heaps. No man can succeed unless he knows, from his system of accounts, just where he stands, and an electric-light company cannot know where it stands by keeping only a customers' ledger and a cash book. By pitting one manager's results against the other, or by comparing one with many, greater developments can be obtained both in getting new business and in effecting savings in operation. When full advantage is taken of the "deadly parallel" in these comparisons, astonishing results are obtained.

No small company by itself can employ, of course, the staff of specialists which constitutes the operating force of a holding company, yet each individual property in a holding company of the proper kind can enjoy the advantage and services of such specialists. Legal and corporate affairs, for example, are often sadly neglected in the small company, but naturally receive more careful attention in consolidations.

The raising of money for the growing needs of the property has been the blank wall beyond which many a small company could not go. The company's credit may have been exhausted, and the stockholders, already tired of putting surplus earnings back into the plant to keep pace with the growth, refuse to invest new money in what seems such a profitless venture. What a blessing, then, to be part of a holding company whose securities have a ready sale, so that all the money necessary can be raised, and the expansion, previously only the manager's dream, can become a reality!

Disadvantages of Consolidation

Of the disadvantages little need be said. These disadvantages are common to all lines of big business. Organization details are tiresome, but to some extent necessary. In a large company the memory of the individual must be eliminated, and, unfortunately, his integrity cannot be made an elemental part of a transaction. Everything must be made a matter of record, so that in case of death, sickness, forgetfulness or dishonesty the affairs of the company will not suffer anything more than a temporary inconvenience. This necessity breeds "red tape," which can be made obnoxious or beneficial according to the individual qualifications of the man or men responsible for it.

The lack of personal contact with the public and the odium toward a "foreign" corporation can both be offset by insistence on the "square deal" policy, by keeping out of the unpleasant side of politics, by contributing to the growth of the town by both effort and money, and by doing locally all possible purchasing. Difficulty of quick action in time of emergency should be viewed as a lack of efficiency in the organization in not anticipating such happenings so as to reduce to a minimum the too common heartbreaking eleventh-hour haste to catch up with a vanishing opportunity.

The writer of these paragraphs is an enthusiast on the possibilities of the smaller town, for it is surprising what a competent manager can get out of a very small community, even from a small plant. But from a property which is part of a general system, with proper rates and with better and unlimited service, much more should be expected.

Primary lines are now being sent out as advance agents, creeping into territory formerly considered unworthy of adequate investment. Such lines are already showing a

profit, so that new lines are being built, and thus it will continue. Our brethren of the Western States have shown us the lead in this, and soon the country will be covered with a primary network connecting up small communities as our secondaries now connect up individual customers. The station manager is realizing more and more that it is the increment cost of the additional business, and not the average cost of all service, that counts in gaging the possibilities of new fields and additional business.

The past few years, especially the last year, have been periods of tremendous development in all lines, and statistics, when compiled, must show great development in the electrical field. Holding companies with capital stock running into many millions of dollars no longer cause more than a passing comment, and those built on a firm foundation present one of the safest forms of present-day investments. Those in which properties have been purchased at prices which discount future growth for years to come, or which represent in their securities issued large personal profits for the promoters, may be sad exceptions, but it is inevitable in any great movement for the general good that there shall be such exceptions, and they can but educate the public to a proper discrimination.

The year has been one of great achievements all along the line. It stirs the red blood to be a part of such a conquering army, and makes one glad to be alive and wish to live to see and help in the consummation of this ultimate expansion.

Industrial Electrical Applications

By E. W. Lloyd

ONLY a person closely associated with the central-station business during the past ten years can realize the tremendous increase in the use of electricity from these stations for industrial purposes throughout the United States. This increase can, perhaps, be better understood when we consider that ten years ago in a center as large as Chicago the amount of electric service furnished manufacturing plants was so small that a contract for approximately 400 hp was one of the first permanent large installations and was considered in its day to represent a great advance. While incomes from other kinds of business had been greater still, the furnishing of electrical energy for motors to a manufacturer was thought to be quite a wonderful achievement.

Large buildings in the retail business district had already been supplied with electrical energy in comparatively large quantities, and in the clothing industry contracts of reasonably large proportions were in force. But in the manufacturing districts in the outskirts of the city it was considered impossible to purchase electricity from central-station companies, not only because of the high cost, but on account of the unreliability of the service.

At that time it was also true that very few central-station companies had organized sales departments, and this, without question, was one of the reasons for the slow development of the business. Of course, consideration must also be given to the fact that there were then very few men who had been trained as central-station salesmen. Indeed, even up to this time too little definite work is done in this connection, although we see in all lines of industry attempts to increase the efficiency of salesmen. Manufacturers in the electrical field are now giving a great deal of attention to the subject, and several of the larger central-station companies have established, or are about to establish, schools for the education of their men. The demand for men of this class is very great at the present time. For one having a fairly reasonable knowledge of salesmanship and the necessary technical training that is required of a central-station salesman, the future seems very bright indeed.

Those foremost in the development of the work of the National Electric Light Association have recognized the desirability of establishing a branch of the association devoted exclusively to the sales end of the business. The result has been the formation at the St. Louis convention in 1910 of the Commercial Section. This section has rapidly developed and to-day is recognized as a valuable addition to the association. It not only has the support of the men in the sales end of the central-station business but has also interested the manufacturers. The latter recognize with approval the achievements of the central-station salesmen, knowing that their success means more and larger sales for manufactured apparatus and supplies.

The N. E. L. A. Commercial Section has endeavored to place information of value in the hands of central-station salesmen. This information consists in part of statistics on the motor requirements of different industries. The latest result of this work has been the publication of the "Electrical Salesman's Handbook," which is being issued quarterly by the N. E. L. A. The first number of this publication was delivered to Commercial Section members in June, 1912, and the first quarterly has just been mailed. Contained therein is valuable matter from different companies all over the United States. In addition, the section has endeavored to place in the hands of member companies such pamphlets as "Electricity in the Home," "Decorative Street Lighting," "Sign Lighting," "Factory Lighting," etc. All of this work is part of the plan for the betterment of central-station business, as applied not only to industrial service but to other branches of the industry as well.

More men with better training have been attracted to the sales end of the business in recent years, and the interest of these men has resulted in a tremendous increase in the number of kilowatt-hours sold per annum. These companies have thus been able to reduce their rates, with the result that as their business has increased they have expanded and taken on more and more business until to-day the question whether industrial service shall be furnished by central-station companies as against isolated plants has been practically settled in a large number of communities. Not that the field has been entirely covered, but central-station men can show the possibility of serving electricity economically to any industry or business in many places throughout the United States.

The development of water-power plants has been very great during the past few years, and this, of course, has increased the number of manufacturers buying electrical energy. After securing data from these installations, companies having steam developments have found that the motor requirements of some classes of business (thought to be beyond the reach of such central stations) made it possible for the companies to sell service to these industries in their communities.

Ice Making

A direct example of this tendency has been the rapid increase in the number of electrically driven manufactured-ice plants. The peculiarities of this business at first seemed such as to make it impossible for central stations to furnish the energy, but during the past year or two a number of artificial ice plants have been installed in several large cities, and service is being furnished by central stations. The de-

mand for artificial ice is rapidly increasing, as it is recognized that the water in lakes adjacent to large cities is apt to be in a condition unfit for use. Furthermore, the cost of transportation and labor and the very great outlay for wagon distribution in cities have driven the ice-selling companies to manufacture ice.

These conditions interested central-station companies and considerable time and money were spent in the endeavor to learn the actual requirements of the service, together with the cost of making ice. It is now possible to meet the competition of isolated plants in many places, and already quite a number of motor-driven ice factories are in successful operation.

This is only one of a number of developments of a similar character which have resulted in central-station companies examining into the question of rates for service of this class, known in some cases as "off-peak" service. This term is not always an advisable one to use, because in different parts of the country peak loads occur at different times of the day. In some cases, owing to manufacturing conditions, the peaks occur in the middle of the day in summer, rather than at night during the winter. It is impossible, therefore, to use such a term generally in this connection. In speaking of it the term "limited-hour service" perhaps better defines the class. Central-station companies in many instances can well afford to consider seriously the making of such contracts. The possibility of increasing their annual load-factor is great where such business is available in their community.

Furnace Processes

Another class of business having similar characteristics is in the varied applications of the electric furnace. While a number of large furnaces are installed, the general use of electric furnaces has been very limited. Recently, however, a very active interest has been taken by manufacturers in this development. A number of experiments are now being carried on in various parts of the country, not only in the manufacture of high-grade steel, but in the making of malleable iron and the melting of softer metals, such as brass. The results of these tests are being watched with great interest. A number of central-station companies are able to offer attractive rates for this service. If the brass experiments under way are successful, there will be a very decided increase in the sale of electricity by central-station companies. The increased price of crude oil has, no doubt, had something to do with the interest recently aroused in the possibilities of electric-furnace development.

Taking it all together, there seem to be many reasons for believing that the increase in electricity sold by central stations during the next ten years will greatly extend the progress made in the last decade.

Electric Heating Devices

By W. S. Hadaway, Jr.

THE evolution of new and the refinement of older types of electric heating apparatus have steadily progressed during the year. Manufacturers of materials used in electric heating appliances, as well as assemblers of it, have reached higher standards in their product.

Resistors

Resistor alloys of the nickel-chromium group continue to show commercial value in appliances where the temperatures are high and the size is relatively small. Increased use has been made of these alloys in radiation heaters in which the active material is operated at a glowing temperature.

Incandescent lamps of various kinds have been used as radiation heaters in many ways, although it is obvious that a lamp filament supported in an exhausted glass container is fragile and its field of usefulness limited.

With simple forms of open wire coils available as glowers, the number of applications is materially enlarged. The electrical insulation is simplified, assemblage and inspection of parts are facilitated, and the cost of the finished device is cheapened.

A glower comprising a filamentary carbon core with a synthetically formed envelope of carbide of silicon has recently come into the market. This resistance can be run in open air at incandescence and has many interesting features. Its ability to withstand the rough handling of commercial service, particularly at the terminals, is, however, still to be determined.

Nearly twenty years ago immersion heaters were developed in which insulated resistors were armored so that the structure could be used in liquids with the instrument in circuit. These have found extensive use and a modification has recently been made by which the armored resistor is used in air in a radiation pattern stove.

Glower resistors are of immediate interest in toasters, small room warmers, therapeutic applications and industrially. But of greater importance than the present uses is the possibility of developing the whole problem of space warming in buildings, cars and steamships more effectively than could be done hitherto. Important as the radiation glower is, it must be clearly understood that devices in which the heating resistance is in thermal conductive relation to the active surface constitute by far the greater number of applications. This heat conduction was secured in the earliest constructions by pressure plates which clamped the insulated resistor against the working surface.

The next important step was the development of the vitreous enamel process in which the fused enamel adhered to the working surface, hermetically sealing the resistor within it, which insulated it electrically and supported it mechanically. As the severity of service increased, experience showed that mica under compression was a dependable electrical insulator under the hardest usage. It was necessary, however, to use pressure plates or other comparatively expensive mechanical structures to hold the resistor and its mica insulation in place.

During the past year apparatus has been put on the market in which the metal carriers of mica-insulated resistors are electrically welded to the active surface. This structure gives good thermal conduction from the resistor to the working surface, secures the value of mica under pressure as the electrical insulation to the fullest extent, and is simple and cheap. This construction is probably the most widely adaptable that has been developed in recent years.

Controllers

More attention has been paid during the year to suitable controllers for electrically heated devices and to segregating them as independent items. It has not been generally appreciated what a large percentage of cost the various attachments for connecting heaters to the circuit and for varying the input represent. By treating these devices as separate items a complete line of controllers may be adapted to a group of heaters, as in the home, making it simple to get the greatest refinement in detail at a moderate price.

Light and rugged cord switches giving one, two or three heats are now available. Accessories such as attachment

and connection plugs have been improved and flexible heater cord is now made more carefully. These items in combination make up a group of controllers for heating devices of the greatest importance and are appreciated by the user in the added convenience and security which comes from their use.

Controllers for electric irons comprising a metal box in which a switch, fuses and signal lamp are placed, together with cord-supporting arm, iron-stand bracket, etc., are properly regarded as integral parts of an iron installation. An equipment of this kind is the best possible answer to any criticisms which may be raised by the Underwriters or others as to the fire hazard caused by electric irons.

One make of electric irons is equipped with an automatic temperature regulator which employs a condenser to protect the contacts. Other makes of heavy irons are fitted with external points and lever arm so that the temperature can be regulated manually. Light metal parts subjected to heavy vibration as well as to the oxidation resulting from the high temperatures at which these devices are used do not prove durable. It is desirable, therefore, so far as possible, to eliminate delicate parts from apparatus of this kind.

Integrated temperature control of the larger devices, such as ovens, has been developed. These controllers employ the same automatic accessories that have been used in motor-controlling devices. The features of accurate and automatic temperature control are of the same relative importance to heaters as the various forms of motor control have been to the growth of the motor industry and are an essential part of the broad development.

Practically all kinds of heating apparatus require heat insulation in some degree. The electric oven is perhaps the most important device, requiring heat insulation of the highest order, though the advancement of heat-storage systems in which electricity is absorbed at unity load-factor depends upon the development of effective heat insulation. Fibrous or wooly silicates, usually made from molten slag, have been extensively used as heat insulators. A "popped" silicate has recently been made available. This may be obtained by drying a soluble silicate and continuing the heating until the water of crystallization is driven off and the mass "pops" or effloresces. It is a very light material and can be made up in fine or coarse pieces as desired.

Heat Storage

The work which was done many years ago on heat-storage systems is now beginning to receive recognition. The first installations were designed to absorb energy in large volume at off-peak periods so that heat could be made available continuously without overlapping the heaviest loads. Many modifications have been tried, including the use of electrical energy continuously in small quantity or at unity load-factor, so that large amounts of heat can be made available for short periods.

Apparatus to accomplish this latter purpose is now in the market designed for attachment to the ordinary kitchen boiler. The heaters generally use from 300 watts to 500 watts and are commercially effective according to the care used in placing heat insulation on all parts of the system and the price paid for energy for this special service.

The heat storage at high temperatures is ordinarily obtained by the use of thoroughly insulated materials such as iron or soapstone or the two in combination. Materials the heat capacity of which increases rapidly with temperature rise are preferable. These devices have been made in the form of recessed blocks, serving as oven chambers, with pipes cast or molded in for heating the water rapidly as required, and also as cylinders which may be rotated or moved laterally when imparting the stored energy.

Heat-storage ovens of varying types are broadly included in this problem. These may be comparatively small, as in the "fireless cooker" for home use, or very large and heavy, as in the bake ovens adopted by some of the navies.

Enough has been done in the past dozen years on heat storage to show the merits of the various possible methods and to show it to be the most important question with which the heating engineer has to deal at present.

Tendencies in Illuminating Engineering

By L. B. Marks

A BRIEF résumé of some of the activities in the lighting field during the past year will serve to indicate the trend of lighting practice and the tendencies in the development of the science and art of illumination. It can hardly be said that any single stride in illuminating engineering marks the past year as epoch-making. The work of the year represents rather the crystallization of thoughts and ideas of former years and the extension and widening of recent activities.

Education and Co-operation

If any one fact stands out more prominently than another, it is the great activity of the members of the lighting fraternity in educating themselves in the use of light, whether from the economic, hygienic or esthetic standpoint, and in educating the public. The broad attitude of the electric light companies, the gas companies and the manufacturers of lighting appliances in educating the public to use light properly is especially notable; witness the extensive publication by these interests of articles dealing with the intelligent use of light in the home, the workshop, the store, etc., and the wide publicity given to the primer entitled "Light: Its Use and Misuse," which has been prepared under the direction of the Illuminating Engineering Society.

The up-to-date central station or gas company now has its illuminating engineering department, whereas only a few years ago such a department was the exception rather than the rule.

The spirit of co-operation between the diversified interests that have to do with light and illumination has been more marked during the past year than in any year since the formation of a separate society devoted to the development of illuminating engineering. Joint meetings between societies of engineers, architects, decorators, oculists, manufacturers' associations and others for the purpose of exchanging views have been numerous, and as a result of these meetings the importance of the subject of lighting in its various aspects has been impressed to a greater extent than ever before not only upon those immediately interested but upon the general public.

Although no well-rounded college course in illuminating engineering has been established, the colleges are gradually including illuminating engineering work in their curricula and are devoting some time to lectures on the subject, notably in England.

A significant step in the world-wide spread of illuminating engineering is instanced in the recent formal organization (November, 1912) of the Illuminating Engineering Society of Germany, under the auspices of the Physikalisch-Technische Reichsanstalt. The latter body is a government institution.

Safety and Hygiene

The subject of light as a factor in safety has received special attention at the hands of the American Museum of Safety. The latter institution has organized a lighting section, the purpose of which is to preach the gospel of hygienic lighting and to disseminate information calculated to lessen the loss of life and limb due to inadequate or faulty lighting.

The hygienic aspects of lighting received special attention during the past year at the international Congress on Hygiene at Washington, and notably at the Congress for the Prevention of Industrial Accidents at Milan, at which a paper on the subject was presented by the president of the Illuminating Engineering Society. A committee recently appointed by the government of France is charged with the investigation of questions relating to the hygienic use of light.

Legislation

Lighting legislation received a great impetus in Great Britain because of the disclosures that were made in the report of the chief inspector of factories and workshops. This report contained the results of an elaborate investigation of the lighting of some 125 factories and workshops in which measurements of illumination were made. The bad lighting conditions revealed in the report prompted the British government to take steps to enact such legislation as will compel the owners of industrial establishments to remedy existing evils.

The New York State Factory Investigating Commission has just formulated a bill for the provision of "adequate and sufficient lighting of factory buildings." This bill was submitted to the Illuminating Engineering Society to consider the technical features of the proposed legislation from the illuminating engineering standpoint, with special reference to safety and ocular hygiene. It is expected that the proposed legislation will be enacted during the first session of the new year.

Plans are now on foot to extend the scope of lighting legislation to cover schoolrooms, public buildings, etc.

Interior Lighting

The growing introduction of "indirect" and notably "semi-direct," as distinguished from direct, lighting has been one of the features of the past year. Illuminating engineers have preached diffusion of light to such an extent that the public has been led from one extreme to the other; that is to say, from the use of lighting units in which clear glass lamps are exposed to the use of lighting units in which the lamps are totally concealed by opaque reflecting shades. The tendency now is to compromise between these two extreme limits by the use of units in which the lamps are concealed by diffusing shades of glass or other material, the lighting thus being carried out partly by direct but mainly by indirect means.

The study of glare from the lighting source and glare from the objects illuminated has received marked attention during the past year, especially at the hands of a committee of the Illuminating Engineering Society, and has led to a better understanding of the principles of diffusion of light. The increasing use of diffusing shades on lamps is an illustration of this tendency. Another illustration is the introduction of table lamps and desk lamps in which all of the light comes indirectly from a comparatively large diffusing shade which surrounds the lamp. In connection with the elimination of glare and the conservation of vision the increasing use of paper having a dull finish, in monthly magazines and other literature, is worthy of note.

There has been a marked tendency in lighting installations to give more consideration than heretofore to the artistic and esthetic aspects of lighting.

The production of artificial daylight has received considerable attention during the past year, but progress in this field has been in the direction of subtractive rather than synthetic methods of producing light of daylight quality.

For restricted use, as, for example, in a small room for color matching, it is now possible to produce without forbidding expense artificial light approaching in quality any desired quality of daylight.

The year has witnessed a growing tendency on the part of manufacturers of shades and reflectors to supply complete lighting units including the fixtures. This plan makes for a proper co-ordination of the parts of the lighting fixtures as such, to secure the best illumination results.

The tendency of the times is to apply illuminating engineering principles to decorative lighting, not only to secure esthetic effects hitherto unattained, but to secure these effects with the least expenditure of money for electric energy or for gas.

Exterior Lighting

The open and the inclosed carbon arc lamps for street lighting are gradually giving way to luminous and inclosed flame-arc lamps and to high-candle-power tungsten lamps. The replacement of the older type of lamps by these newer and more efficient types has been especially notable during the past year.

High-pressure gas lamps rivaling the most efficient electric lamps have made some headway abroad, but owing to adverse conditions that obtain in this country have been introduced here to only a limited extent.

The quartz tube mercury arc lamp has come into the field as an active competitor for exterior lighting by high-candle-power units.

The tendency in street lighting has been to increase the standard of illumination not only for the commercial and main thoroughfares but also for the residential streets.

The movement begun a few years ago to install in the main thoroughfares, and especially in the business districts, ornamental standards usually equipped with four or five tungsten lamps inclosed in diffusing globes has made much headway during the past year. The mantle gas burner has also been used for this purpose.

With the development of the more efficient lamps of high candle-power, the tendency has naturally been to mount the lamps at a greater height from the street level, thus reducing the glare effect and widening the distribution of the light.

There has been a marked tendency to evaluate street lamps on the basis of total flux of light and distribution of flux rather than according to any arbitrary candle-power rating of the lamp. The old arc lamp rating of 2000 nominal candle-power, which formed the bone of contention in many litigations between lighting companies and municipalities, may be said to have received its death knell during the past year, notably in the decisions of the Wisconsin Public Service Commission.

Photometry, Nomenclature and Standards

The development of illuminating engineering created a demand for accurate portable photometers for the measurement of light and illumination. Photometers of this class, compact in size and comparatively inexpensive, have been developed in this country and abroad, and during the past year several simplified types have been placed on the market at a price low enough to be within the reach of most people that have need for such instruments. Developments in photometers and photometry have made it easier than heretofore to obtain quickly an accurate measurement of the total light flux of a lamp and have made it possible to secure a correct comparison of lights of different color value. The use of photography in the solution of photometric problems has opened up a new field.

In the development of a new science the need of agreement as to the exact meaning of terms is manifest. The language of illuminating engineering has not only been inexact but has led to confusion which, in a measure, has retarded the development of the science.

An important step looking to the establishment of definite nomenclature and standards throughout the world was taken the past year in the movement to hold an international congress which will deal with the terminology of photometry and illuminating engineering.

Developments in Electric Lighting

By Preston S. Millar

DURING the past year, 1912, there has been an appreciable improvement in illuminants and in lighting practice, but there has been no radical improvement in any one feature. Progress has been evolutionary rather than revolutionary.

Illuminants

The carbon-filament lamp has become an outcast during the year. The demand for it has become so small that it is impracticable for manufacturers to furnish the same rating and selection of product as formerly, and, indeed, it is understood that they will be unable to sell carbon lamps under close specifications hereafter. It may be recorded that the carbon lamp, as far as general practice is concerned, became obsolete with the close of the year 1912.

The metallized-carbon-filament lamp, which was adopted some two or three years ago as the standard free-renewal lamp by the larger central stations, took its place during the year as the standard central-station type for use whereever tungsten lamps were not employed. Although at all times slightly more fragile than the carbon-filament lamps and therefore less suitable for use where ruggedness is of paramount importance, the higher efficiency of the metallized-carbon-filament lamp has won for it its place as the principal central-station type of lamp. Minor improvements in manufacture bettered its performance until it is to-day fairly satisfactory, though of shorter service life than the lower-efficiency carbon lamp. As far as general use is concerned the 60-watt lamps are practically the upper limit for wattages. The 30-watt lamp, now the smallest size, was a newcomer during the year.

Domestic tungsten lamps have attained such a degree of general excellence that they leave no adequate excuse for the further extensive use of carbon or metallized-filament lamps. Extreme fragility may no longer be urged against them; in fact, they exhibit less mechanical breakage in railway and surface car service than do metallized lamps. In life the product has been improved so rapidly that the performance, at least in the laboratory, exceeds the guarantee of 1000 hours to 80 per cent of initial candle-power or to earlier failure.

Probably the most far-reaching and important improvement in illuminants during the year has been the general introduction into the construction of tungsten lamps of a bulb-blackening preventive which very greatly improves the candle-power maintenance. Prior to the successful development of this feature of construction, the candle-power maintenance of the smaller lamps was excellent, but that of the larger lamps, 150 watts and above, left much to be desired. It is, therefore, in these larger lamps that the bulb-blackening preventive has been applied with greatest success. To illustrate its effect it may be stated that the life to 80 per cent of initial candle-power, which for the 500-watt lamps of 1911 was of the order of 300 hours, has been found during the year 1912 to be of the order of 1500 hours for the improved lamps. Great as this improvement has been, it is understood that there are probabilities of further successful development.

With this improvement in performance in tungsten lamps there is gradually coming about a greater ruggedness, a greater consistency in candle-power and wattage rating and an improvement in the mechanical construction of the lamps. All things considered, the domestic tungsten lamps are now a thoroughly satisfactory product.

The inclosed carbon arc lamps are still used largely in street lighting. The intensified carbon arc lamps, because of the desirable color of the light, which is almost white, still find application in certain classes of store lighting.

The feature of the year in the arc-lamp situation in this country has been the development of the long-burning flame-arc lamps with mineralized electrodes for street-lighting purposes. The further development of this type of lamp is awaited with much interest. The progress has been very encouraging, although the lamps still leave something to be desired in reliability of operation and constancy of light output. If the manufacturers succeed in making these lamps as reliable and steady as the old carbon arc lamps, it is probable that they will be adopted for street lighting in many installations, displacing the inclosed carbon arc lamps, with a consequent increase in illumination intensities, which is much to be desired. The sacrifice in efficiency which is made in order to secure the long-burning feature will not militate seriously against the usefulness of the lamp for American street-lighting service, provided thorough reliability and steadiness may be assured.

The growing demand for white-light electrodes in flame-arc lamps is not being met in a satisfactory way, attempts so far resulting in light which is not white.

The magnetite or metallic-flame lamps with metallic electrodes have continued to demonstrate their worth in street-lighting service. The principal development has been the modification of the lamp in order to apply it for street-lighting service in connection with an ornamental pole which adapts the system for decorative street lighting.

There have been no notable developments in low-pressure glass-tube mercury-vapor lamps. The high-pressure quartz-tube mercury-vapor lamps which have been used in Europe to some extent in recent years have been exploited commercially in this country during the year. In industrial lighting of large areas the lamps have rendered service which is encouraging to the manufacturers, and in Chicago they have had a limited trial for street-lighting purposes.

Central-Station Attitude Toward Tungsten Lamps

During the past five years the problem created for central stations by the tungsten lamp has occasioned much study and discussion. Extended consideration and preliminary trials appeared to give weight to the view that opportunities which the new lamp created for extension of lighting and motor service were sufficient to counterbalance the immediate loss in revenue due to the use of lower wattage lamps.

In varying degree the lamp has been exploited by the central stations of the country. It is general practice for the central stations to sell rather than give the lamps to their customers. Prices range from the standard retail values down to values which are considerably below the net cost of the lamps to the central station. Probably only about one-third of the lamps produced in the country during the past year have been tungsten-filament lamps. It is there-

fore seen that, in spite of the good qualities of the newer lamp, carbon and metallized-carbon-filament lamps are still used very largely. As the price of the newer lamp is reduced—and it appears reasonable to anticipate some further reductions—and as its merits become more generally appreciated, it is likely to be used more and more generally, displacing the older, less efficient lamps. Its general use, however, is not likely to be brought about until central stations which give free renewals of lamps to customers adopt the tungsten lamp as the standard type. It is understoood that progressive central-station sentiment has had this in view for some time and that the performance of the lamps is being studied closely with a view to ascertaining when the price shall become sufficiently low or the life sufficiently long to permit the lamps to be given to customers without increase in the free-renewal cost. This problem is intimately connected with efficiency adjustments and therefore the lamp manufacturers have it somewhat within their control. Further improvement in the lamp life or further reduction in price of the lamps may make free renewal practicable, unless it is accompanied by an increase in the efficiency which will shorten the life.

Illumination

The activities of manufacturers of lamps and lighting auxiliaries in co-operation with central stations have brought about large advances in some classes of lighting practice. The lighting of large stores and the better type of shops has been improved and developed to a greater extent than has lighting of other classes. Wherever the advertising incentive is present the problem of improving the lighting is simplified and progress is made. Fortunately the principles of good lighting, as rapidly as they are made known, are being embodied to a greater or lesser extent in the commercial output of lighting auxiliaries as well as in the installations of new lighting systems. In consequence the improvement in the new installations is very manifest.

The commercial incentive being lacking, the practice in lighting residences and certain classes of offices lags behind, and there has been little improvement during the past year.

In street lighting the demand for higher intensities is gradually making itself felt, although in some cases it serves merely to reveal more clearly the inadequacy of street-lighting appropriations. Merchants' display lighting has been very influential in creating and emphasizing this demand. Tungsten cluster lighting appears to have attained its zenith, at least as far as existing forms of application are concerned. Its notable success has naturally led to the development of competitive systems, such as the decorative magnetite system, and it is probable that the effect of this will be to react upon tungsten street lighting in a beneficial way and that the latter will be applied in a more generally acceptable and wholesome manner in the future.

In New York State legislation has been proposed in connection with factory inspection laws with a view to eliminating some of the more serious ills from defective lighting in industrial establishments. While the effectiveness of this effort remains to be demonstrated it is worthy of note that the increasing attention which is being given to illumination in general is thus reflected in proposed state legislation.

In general, the growing appreciation of the esthetics and hygiene of illumination is one of the most satisfactory developments of the year. Taken as a whole, the progress has been material and along right and proper lines, but the year has not been characterized by any single radical improvement which outshines all other improvements.

Progress in Photometry

By Herbert E. Ives

AMONG the photometric researches of the year two lines of endeavor are of paramount interest. One is the study of colored light photometry, the other the continuing effort to find an objective photometer or substitute for the eye. In a review of photometry these deserve the first and most detailed comment.

The difficulties of colored light photometry, together with the requirements of a method for such photometry, have been so often stated as to need but little recapitulation. The drawbacks are of three kinds—those due to the physiological or psychological characteristics of the eye and brain; those due to differences between observers, and those peculiar to the instruments or methods of photometry used. The requirements of a method of colored light photometry are, first, that it shall measure true brightness and not some other complex function of radiation and seeing mechanism; second, that it shall conform to certain simple mathematical axioms—things equal to the same thing must measure equal to each other and the sum of the parts shall equal the whole—and, third, that it must have a certain degree of sensibility.

The Flicker Photometer

Investigations published during the year show that just one photometer—the flicker photometer—possesses these requirements. While measurements by so-called equality-of-brightness, visual-acuity and critical-frequency-of-flicker are subject to most extraordinary deviations from the requisite axiomatic conditions—deviations which are due to more or less obscure psychological influences, chromatic aberration of the eye and what not—the flicker photometer, on the other hand, rises serenely to every test. It has also the advantage of showing the greatest sensibility of all methods in working with differently colored lights. Finally, it gives the same relative brightness values as the "equality-of-brightness" method when the mean of many observers and many observations is taken or when the "cascade" method (steps of small hue difference) is employed. However, while the flicker photometer gives the results at once, the other procedures are long and tiresome.

There is every reason for confidence, and even for enthusiasm, over the flicker instrument, but such feelings must be held within proper bounds by the knowledge of certain of its restrictions. It is not so quick or so easy to operate as an equality photometer when the latter is used with lights of the same color. It has peculiarities of its own, such as a reversed Pinkinge effect when operated at very low illuminations. It does not abolish the differences between observers; hence, it is just as necessary with it as with any other method that will ever be found to use a normal eye, or—the same thing—the mean of many observers. But to catalogue the limitations of the flicker photometer is to point out the means to minimize them. The flicker photometer must be looked upon as a standardizing laboratory instrument, whereby auxiliary standards of the various colors required in the industries shall be prepared by observers of normal vision. A definite illumination, preferably a high one, must be selected as standard and at this illumination lights of different color shall be rated and shall be one candle-power or some multiple thereof, just as a standard metal bar is one meter long only at a standard temperature. All observers of whatever type of vision may use these auxiliary stand-

ards by the usual sensitive methods of homochromatic photometry, securing concordant results, of values such as would hold under standard illumination and visual conditions. Only under unusual conditions or in special problems would correction be called for, such as under very low illumination or where great detail-revealing power is needed. Recourse to such "quality factors" may be aptly compared to the use of temperature coefficients of expansion in delicate linear measurements.

Physical Photometers

Granting that the results yielded by the flicker photometer under certain conditions be adopted as standard, a new impetus is given to physical photometers. In these might be incorporated the characteristics of the normal eye, thus doing away with the need for numerous observers or for correcting factors to abnormal observers in the standardizing laboratory. Long before colored light photometry became important, objective photometers were, of course, sought, but it has always been doubtful whether any of the suggested schemes promised as great sensibility for homochromatic photometry as that wonderful instrument the eye. Among these suggested means are included the selenium cell, the bolometer and thermopile, the photographic plate and, lately, the photo-electric effect.

The main requirements of an objective photometer may be summarized as sensibility, convenience and adherence to some simple law of response to varying light intensity. If colored lights are to be measured, it must besides be possible to give to the device, as by screening, the color sensibility of the normal eye.

Selenium has long held the center of the stage because of its great change of electrical resistance when exposed to light. But work recently published shows that far from obeying a simple law the resistance varies as the square root of the intensity for parts of the spectrum and directly for other parts of it. So extremely complicated are these phenomena that selenium seems definitely ruled out, except of course for strict substitution work with monochromatic light. The bolometer and the thermopile are altogether too insensitive for present requirements.

Photography in Photometry

The photographic plate has been experimented with during the year and found applicable to certain special cases, such as the recording of candle-power distribution curves and of fluctuating light sources. With steady illuminations of ordinary color photography cannot claim to equal the eye, either in convenience or in accuracy. Of all physical photometers the photo-electric cell made of one of the alkali metals seems most promising. Its response varies directly as the illumination over an enormous range; it possesses great sensitiveness, and its maximum of color sensibility lies in the visible spectrum. Unless further study should prove it to have eccentricities similar to those found in selenium, there is good ground to hope for the applicability of such a cell, properly color-screened, as a laboratory normal eye. Mention should be made, too, of the application of the photo-electric cell to measurements of the transmission of microscopic areas, such as the densities of photographs of spectral lines. But on the ground of quickness or convenience for ordinary photometry none of these visual substitutes can make great claims. They require special and delicate auxiliary apparatus. The eye is still supreme as a judge of the equality of illumination of the same color, and it is only when it becomes inadequate, as in colored light photometry, or where the illuminated surfaces are of peculiar size or position that a less convenient instrument has an opportunity to play its part.

Other aspects of photometry of course have not been neglected. Among the novelties of the year are two types of binocular photometers, for which great sensitiveness is claimed, a reflectometer, a type of variable neutral-tint screen and a special candle-per-watt meter.

In the matter of photometric standards, undoubtedly the most important feature is the discussion which still continues of the proposal to measure light as radiant power, weighted according to its ability to cause the sensation of light. By this means we shall attain an absolute standard of light, defined as nearly as possible in terms of the fundamental c. g. s. units. The theoretical merit of this standard seems generally admitted, and we now only await its practical achievement.

Developments in Electrochemistry

By E. F. Roeber

In most of the large and firmly established electrochemical industries of carborundum and alundum, artificial graphite, calcium carbide, phosphorus, caustic soda and chlorine, electrolytic copper refining, etc., no radically new development during the past year can be recorded, but note can be made of a quiet, steady, effective evolution along conservative lines and in various respects a commercial expansion into new fields of industrial usefulness. Three particular subjects, however, deserve a special review at this place—the status of the electric furnace in the iron and steel industry, the activity of inventors in reducing the cost of production of alumina for the manufacture of aluminum, and the various electrochemical processes in the fertilizer industry.

The Electric Furnace

In the use of the electric furnace for steel refining the United States Steel Corporation has taken a leading part, especially with respect to large-tonnage products, such as rails. The long list of breakages of rails, resulting in disastrous railway accidents, has become a very serious matter, and credit is due to the United States Steel Corporation for having undertaken to determine what can be done with the electric furnace to relieve the situation. From Mr. W. R. Walker's authoritative statement, made for the corporation in his paper before the American Iron and Steel Institute, the following sentences are significant: "At the present time (May, 1912) there are approximately 5600 tons of standard electric steel rails in service in the United States. These rails have been in the track about two years. During the past winter some of these rails have been subjected to very low temperature—in some cases as low as 52 deg. Fahr. below zero—and are being exposed to all the possible conditions of severe service. . . . Up to the present time we have not heard of any basic electric rails in use in this country being broken in service." It will be remembered that the steel for these rails is basic Bessemer converter metal transferred while in molten state to the electric furnace for refining. Mr. Walker's statement augurs well for the future of the electric steel rail. But it is evident that before transportation companies shall be willing to pay somewhat higher prices for electric steel rails for general use the experience of more years must be available. Although the commercial development will be necessarily slow, yet the outlook is bright.

The electric furnace for refining steel for high-quality products (tool steels, etc.) is proceeding quietly and very

satisfactorily. Several new furnaces have been erected. The electric furnace has been introduced into foundry practice for high-quality castings. A special type of electric furnace for heating bars, billets and forgings is finding particular favor at present as a result of the recent considerable increase in the cost of crude oil, which puts oil-firing very much on the defensive.

The use of the electric shaft furnace for iron ore reduction on a large scale (in competition with the blast furnace) is still restricted to the Scandinavian countries and California, where specially favorable conditions prevail. Under ordinary conditions the blast furnace has little to fear from its electric competitor. One result obtained with the electric iron-ore reduction furnace is noteworthy. By reducing the amount of carbon and running the furnace at a low temperature a metal is produced containing 2.2 per cent or less of carbon, a very small amount of manganese and silicon, and one low in sulphur and phosphorus. Being produced directly from iron ore in the electric furnace, it is called "pig steel," as it contains fewer impurities than pig iron and therefore requires less refining for making finished steel. This is probably the most hopeful feature of the evolution of the electric iron-ore reduction furnace.

Aluminum Production

Any progress that promises to cheapen aluminum is of particular interest to the electrical industries in view of the competition between aluminum and copper especially for line construction. The electrolytic production of aluminum from alumina is now so developed that little saving may be hoped for in this step of the process. The trend of invention is, therefore, to cheapen the cost of the raw material—the alumina—and there is at present a large activity in this field. Besides several processes which are being kept carefully secret, two loom large in the limelight. The first of these is a new process of Mr. Alfred H. Cowles for obtaining alumina, hydrochloric acid, caustic alkali and white hydraulic cement from clay, salt and lime. The cheapness of the starting material, clay, and the production of the various by-products are to result in a much reduced cost for alumina. A plant for developing the process on a commercial scale has been erected at Sewaren, N. J. The second or Serpek process, which has been in use for a longer time on an experimental scale in a plant in France, produces aluminum nitride as an intermediate product and finally yields pure alumina and ammonium sulphate. It therefore represents a combination of the production of alumina with the fixation of atmospheric nitrogen. The production of the by-product, the ammonium sulphate, reduces the cost of alumina. Both processes are interesting in another respect. Mr. Cowles hopes to make his process available for the extraction of potash and thus to found an American potash industry which should make this country independent of Germany. In the Serpek process the ammonium sulphate by-product is also a fertilizer. Both processes, therefore, also afford an indication of the marvelous present activity in fertilizer chemistry.

Electrochemical Fertilizer

Among the electrochemical processes for the production of fertilizers the two largest are utilized in the production of nitrates from atmospheric nitrogen by electric discharges through air and in the production of calcium cyanamide. Both are commercially successful. Concerning the wonderful growth of the Norwegian nitrate industry, using the Birkeland-Eyde process, it is noteworthy that in less than ten years this industry has grown to be one of the largest in Norway, utilizing that country's enormous available water-powers, which can be developed at a very low cost while the electric energy could not be utilized in full for other purposes under local conditions.

As to the progress of calcium cyanamide, it is interesting to note that the Niagara Falls works are to be largely increased. Finally, it may be mentioned that the synthesis of ammonia from elementary nitrogen and hydrogen gases is now an accomplished fact, as a result of the commercial development of the Haber process by the Badische company. While it is not an electrochemical process itself, it is likely that the hydrogen gas needed as raw material will be made electrolytically.

Thus in the wonderful present growth of fertilizer chemistry—one of the greatest developments undertaken by science for the welfare of mankind—electrochemistry is taking properly a prominent part.

The Storage Battery Industry

By Lamar Lyndon

THE storage-battery business for the year 1912 has been satisfactory, several manufacturers having made provision for substantially increased productions. The demand for vehicle-type batteries in particular has shown a heavy increase, and steam railroad companies have been liberal purchasers of batteries for train-lighting equipments. Electric-light companies having three-wire direct-current distribution systems have installed a number of extremely large standby or reserve batteries, and a considerable number of small batteries for 30-volt or 60-volt distribution have been installed in connection with gasoline-engine-driven outfits for house and farm lighting.

No striking improvements in either cell or plate construction have been made during the year. With lead batteries for stationary purposes there is an increasing proportion of the output furnished with pasted, or Faure type, plates, both positive and negative, and where the required number of discharges a year is limited or low charging rates only are available this type of cell shows certain advantages. Initial cost and floor area are considerably reduced, and with a limited number of discharges, as with "standby" or reserve batteries, the maintenance is not materially increased. For vehicle batteries of the lead type pasted plates are now used exclusively, Planté-type plates adding too much weight requiring too much space and being too costly. It is still premature to express a definite opinion as to the merits of the special vehicle types, including the envelope lead and alkaline nickel-iron batteries, as they have not been in service sufficiently long. The much higher first cost of these types would seem to cover amply even the claims made for longer life. The different lead-battery makers seem to have revised their opinion in regard to giving pasted-plate batteries "boosting charges," and this practice is now frequently recommended where the service requires it. Planté-type positives are still recommended as being far more durable for regulating work or for those applications requiring frequent discharges. The Planté-type negative has demonstrated its excellent life.

The Storage Battery and the Automobile

Electric pleasure vehicles are increasing in use, especially in the cities of medium size. The electric truck, however, while showing a great increase in application, is not being adopted as rapidly as its economy would warrant. While those technically informed are clearly recognizing the proper respective fields for the gasoline and electric wagons,

those who are making their initial venture in motor trucks are not always so fortunate. Impressions gained from experience with pleasure gas cars are carried over into trucking applications and are not likely to be correct. The much more extensive advertising of the gasoline truck and the results obtained point a strong moral to the electric truck builder. The Electric Vehicle Association of America, the National Electric Light Association and the Association of Edison Electric Illuminating Companies are conducting campaigns which will no doubt lead to a more satisfactory increase in electric vehicles. In many cities extremely promising results are already obtained. The importance of the battery-charging load is clearly brought out by the result obtained by the Denver Gas & Electric Company, whose revenue from vehicle battery charging during the past year has been approximately $60,000. This is double the income for the preceding year, and the same ratio of increase is confidently expected for the coming year.

It will be noted that a large proportion of the gasoline car manufacturers are offering electric lighting outfits and electric self-starters as a part of their standard equipments. While the required batteries for these purposes are small, the number of batteries is great. Small electric freight transfer and baggage trucks are being employed by steamship and railroad companies at their terminals with profit, and this application of storage batteries promises to be of great importance. Storage-battery locomotives for mining, tunneling and industrial works are being widely used, and one prominent electric manufacturing company is offering a complete line of such locomotives. The contracting companies for the New York City aqueduct tunnel have a number of such locomotives in service and express themselves as being thoroughly satisfied with their economy.

The storage-battery car venture of the Third Avenue Railroad Company has proved completely successful, and the days of the antiquated horse car in New York City are surely numbered. An additional 200 or 300 storage-battery cars are in immediate prospect for the remaining horse-car lines. Storage-battery cars are now in operation on a number of lines outside of New York and meeting with favor. A number of double-truck cars have been built and a complete multiple-unit three-car train has been shipped for operation in Cuba. Large storage-battery cars are promised for branch-line operation on steam railroads in the immediate future.

Several battery companies have developed 30-volt and 60-volt house or farm lighting plants for gasoline-engine drive, and these are being built in large numbers. It is interesting to note in this connection that several agricultural implement companies and a prominent mail-order house are extensively advertising and selling such plants. A great volume of business is predicted in this field.

The Storage Battery and the Central Station

Few new regulating storage-battery plants have been installed the last few years. The consolidation of generating plants and the load equalization thus obtained from the combination of various loads have seriously reduced this application of storage batteries, excepting in connection with long transmission systems in which case the reserve, or "standby," feature is of importance. The rapid approach of some of the larger transmission systems to their limit of available transmitting capacity will, no doubt, occasion the installation of some large batteries with automatic regulation as a minor feature within a short time. In fact, there are now being installed several batteries where this condition obtains and tenders are requested on others.

The larger companies have made notable installations of "standby" batteries during the past year, and several have either completely changed over their distribution systems in downtown districts from alternating to direct current, largely to secure the advantage of storage-battery reserve, or extended the previous limits of their direct-current service. A number of such batteries capable of discharging at from 40,000 amp to 44,000 amp have been installed, and batteries of 60,000 amp are in prospect.

The submarine boat has attained no mean development, a submerged speed on storage-battery drive of 11 knots an hour having been reached. At a speed of 5 knots an hour, submerged runs of 125 miles are possible. Both our own navy and foreign navies are adding largely to the number of such vessels, and the sizes of submarine boats are rapidly increasing.

Status of the Electric Vehicle

By W. H. Blood, Jr.

THE electric vehicle is fast coming into its own, for the ill effects of its premature start some ten or twelve years ago are rapidly being overcome and forgotten. The success of the newer types of electric cars, with their lighter and more effective batteries, their improved motors and chassis, to say nothing of the better condition of the roads over which they travel, is an established fact. That competition does not exist between the electric and the gasoline vehicle the public is beginning to realize. The first is fundamentally for city service, the second for touring and long-distance duty.

Electric Vehicle Tires

The electric truck is peculiarly adapted for handling heavy loads at comparatively low speeds, and the increasing number of large fleets of trucks that are being installed by companies which are not actuated by esthetic motives but which count every cent demonstrates conclusively that the use of electric trucks is advantageous and commercially economical. Such a vehicle to be successful must, however, be kept in motion; it should not be used in the place of a single horse-drawn truck, but should rather take the place of several horse-drawn vehicles. Failure to recognize this fact in the past accounts for some of the early disappointments.

The electric pleasure car, because of its simplicity of operation and its cleanliness, finds a ready market. All the manufacturers are reporting largely increased sales. The past year has, indeed, witnessed the starting of a number of new manufacturing concerns, which are getting out models of beauty and machines of excellence, rivaling the best product of the well-established concerns.

The Electric Vehicle and the Central Station

The central stations of this country have quite generally adopted the electric vehicle for their own work and are strongly and consistently advocating it for their customers. The impetus which the central stations have given the business, together with the fact that the advantages of motor-driven vehicles are now generally recognized throughout the country, will, it is believed, soon so increase the demand for them that the manufacturers will find it exceedingly difficult to meet it. Unless the electric-vehicle manufacturers put their business in order financially, they will, it is predicted, find their business going to the gasoline manufacturers, who in the main are well

organized financially and are producing results economically. As a matter of fact, many of the gasoline manufacturers are already making, or preparing for the market, electric trucks to supplement their gasoline cars, thus silently but effectively attesting the value of the electric vehicle.

The impetus given to the industry by the Electric Vehicle Association of America cannot easily be measured. This association is to be congratulated on having brought the scattered and competitive electric vehicle and battery manufacturers into connection with the well-organized central-station men of the country. The great amount of general publicity work which this organization has effected during the past year is unquestionably making prospective users of motor trucks consider carefully the electric vehicle, and for the tremendous increase in sales already reported the vehicle association is entitled to considerable credit. The adoption by this association of standard charging plugs and the establishment of a standard base for incandescent lamps are steps in the right direction. A further standardization with reference to the number of battery cells and the speed of vehicles would be welcomed as marking advances in the art.

Reduction in the price of energy charged by central stations is still going on, the larger companies, as usual, taking the lead and the smaller companies fast falling into line. The cost of energy is a small part of the expense in the operation of an electric car, yet the high price previously charged by the central-station companies has militated against the installation of electric vehicles.

Some central-station companies, realizing the difficulty of getting outside capital to start electric garages, have adopted the policy of temporarily opening public garages themselves. This tendency is spreading among the companies in much the same way that the business of "inside wiring" spread in the early days, when there were no reputable wiring concerns to do the business. As soon as reliable independent electric garages can be started the central stations should, and probably will be glad to, go out of this business and confine themselves to their primary function of making and selling electrical energy.

Competition between the two types of batteries, the lead and the nickel-iron, is recognized as an advantage to the industry. While neither is perfect, both are commercially satisfactory, and yet they are so near together as regards merit, and each has its points of superiority so well defined, that the competition acts as an incentive to further improvements, all of which will inure to the benefit of the public.

Throughout the country the "good roads" movement has spread like wildfire. Attention, however, has been devoted almost entirely to roads outside of the city, and all of the money has been spent on the country roads between towns and cities. Little or no attention has been given to streets of cities, in the business sections of many of which the old cobblestone pavement, which is rightly termed a "relic of barbarism," still prevails. Such pavement is injurious to every kind of vehicle and particularly bad for motor-driven trucks. It is believed that considerable energy can profitably be spent in securing better city streets, for this will not only tend to increase the installation of motor trucks but will also reduce the congestion from which all large cities are now suffering.

The above remedy together with the adoption of better traffic regulations rigidly enforced, will do much to take the unsanitary horse from the streets and will materially increase the use of electric trucks and electric pleasure vehicles.

Status of the Telephone in 1912

By Samuel G. McMeen

THE year 1912 produced no epoch-making invention in telephony, but more than any previous one in telephone history it was marked by attention to refinement of details. The early years of telephone development were filled with activity, and the motto was: "Results first, refinement of method afterward." The struggle to meet the demand for quantity of telephone equipment lasted during nearly the entire life of the original Bell patent. Only by the beginning of 1912 had a reasonably satisfactory degree of saturation been reached and attention been directed in a large way to the more promising reductions of wastes and losses and the increasing of important efficiencies.

Utilization of Pupin Coils

One of these endeavors, which was operative in Europe as well as in the United States, was the further loading of long-distance lines and of inter-office trunk lines. The year 1912 closed with a gratifying history in this phase of the art. In the United States loading was continued as previously done, by the use of Pupin coils; that is, by using "lumped" inductance, instead of distributed inductance as employed in cables. In Europe, both methods continued in use with a growth in favor of the Pupin method over others. The year closes with a gratifying increase in practical knowledge of loading, on the part of telephone engineers and managers, and with a singular and interesting lack of knowledge on the part of the telephone-using public. Perhaps this is due to the fact, stated by Dr. Pupin himself, that "It is not a subject which lends itself to popular discussion." The loading of the largest copper wires commonly used in the United States (435 lb. per mile of wire) tends principally to increase the radius of communication. Loading of circuits other than those requiring the largest wires may reduce the total cost of a line for a given grade of transmission over a given distance. The happiest way, however, of reducing the cost of a line, is to reduce the actual amount of metal in it and this, in telephony, is done by the use of phantom circuits. Out of the manifold difficulties of phantom operation has come finally the ability to phantom loaded circuits and to load phantom circuits. To have even one phantom circuit between two points requires the existence of at least two physical circuits. The more physical circuits there are, the more direct phantom circuits may be made from them, and there are no ultimate reasons why phantoms cannot be built upon phantoms indefinitely. Theoretical development of phantom circuits has covered a long period; practical development and wide use of these developments mark 1912 as their banner year.

There are other economic wastes of wire facilities than those which are lessened by the uses of loading and phantom principles. Telephone companies have applied composite and simplex methods to long-distance lines for years but have suffered from the lack of a broad market for the telegraphic facilities so produced. On the other hand, telegraph systems have had within themselves the opportunity for similar economic gains because, fundamentally, two simple telegraph circuits are wasting one telephonic possibility. The coalition of commercial relations of the Western Union Telegraph Company and the American Telephone & Telegraph Company removed a difficulty in this regard. The best interests of the community require the best use of all property belonging to any part of the com-

munity. The years succeeding 1912 will mark further economies in the harmonious operations of the telegraph and telephone facilities in the United States. Such possible expansion was not great in 1912, but the year was notable in its preparatory work. Progress along these lines in Europe was less marked than here, for obvious reasons of governmental inertia. A fourth advance in the economics of wire uses was in the further spread of train dispatching by telephone. As the year closes it may be said that arguments against the handling of trains by telephone have ceased. Other industries than transportation have seen the advantage of the method, and to-day electric lighting and power systems dispatch their loads over lines and apparatus similar to those designed for train dispatching. Telephony has yet to cover that field thoroughly but a satisfactory start was made during the year.

Common-Battery System

The common-battery multiple switchboard remained the standard manual equipment for large central offices. Substantial progress was made, however, in the development of semi-automatic equipment, designed to reduce the amount of incoming-trunk switchboard apparatus and the amount of labor required to operate it. In this regard the year may be taken as the last one of preparatory development and 1913 may be expected to include the installation of many important examples of this system. Its purpose is to eliminate a number of acts heretofore requiring to be done by hand and the substitution for them of the same or other acts performed by mechanisms, these, however, being wholly directed and partly controlled by the intelligence of an operator who retains communication with the calling subscriber. Development in these semi-automatic systems has been dominated by several distinct interests in the United States and is more recently attracting the attention of competent minds abroad. Several of the fundamentals of this practice were reduced to finality during 1912. The way thus is paved for substantial progress hereafter. Semi-automatic systems of the type just mentioned address themselves directly to the elimination of manual incoming-trunk apparatus and manual labor upon it. In a large city trunking 90 per cent or more of all originating calls such machine equipment is likely to be exceedingly important. The contributions of 1912 to that art may well be considered notable. In the greater number of exchanges both here and abroad there is no inter-office trunking at all. In them, if operating labor is to be eliminated in any very great degree, automatic or semi-automatic systems must do all or some of the work of manual operators. The automanual system has had a wider trial during 1912 and has made useful history in the art of doing mostly by machinery what is done on a multiple board by hand.

Automatic Telephony

Automatic switching systems, wherein the subscriber directs and partly controls the switching mechanism and in which no operator other than the subscriber has part, reached a new relation to the using public during 1912. Heretofore the widest use of and interest in automatic switching equipments have been in the United States. The installation of new systems in this country has been less than in other years. The growth in systems already installed went on at a satisfactory rate. No previous year covered more important refinements of detail of automatic apparatus than did 1912, and considering the development of devices for both semi-automatic and automatic systems as a single kind of endeavor, 1912 exceeded all previous ones in total accomplishment. In Europe, furthermore, the automatic idea attracted more attention, received more thought and progressed further toward wide use in 1912 than in any previous year. Certain conditions attending governmental operation of telephone systems make the elimination of operators much more important there than here, and in some quarters it is felt that since automatic telephony is now where manual telephony was many years ago it may reasonably be expected to accomplish the same degree of advance as, for instance, the manual switchboard experienced during the years from 1896 to 1902.

Competition continues to exist in the sale of telephone service; in many cities there still are two telephone systems; in all cities which have or have had two telephone systems the good and bad results of such competition still are in evidence; in some cities where there have been two telephone systems and now there is but one there are murmurings against monopoly, as seems inevitable in all such cases. Happily, there is evident a growing appreciation by the public of the exceeding value of telephone service and of its importance to the general community. This, it is hoped, may simplify the maintenance of satisfactory relations between the server and the served.

Status of the Telegraph in 1912

By William Maver, Jr.

THE most notable progress in the telegraph industry of late has been in the direction of refinements in operating equipment and in the standardizing of such apparatus and line materials, as well as in a closer supervision and better regulation of the traffic. To these factors may be attributed the perceptible improvements in the service rendered the public and in the economy of operation, notwithstanding the new and exacting conditions imposed upon the engineering and traffic staffs by the introduction of the night and day letter service by certain of the telegraph companies in this country, a service which it is said has already resulted in producing an increase of over 20,000,000 messages per annum in excess of the increase in normal business. Improved switching facilities have also been adopted, so that operators in large offices may transfer their table instruments from circuit to circuit by means of small switchboards at each position, in response to lamp signals. In the British telegraph service switching devices are used still more extensively, and at the London main office switching operators save the daily repetition of 18,000 through messages. In the actual transmission of messages over the telegraph wires of this country, while the Wheatstone automatic and the Buckingham-Barclay and the Morkrum telegraph printers are already in considerable use and increasing in favor, it remains a noteworthy fact that approximately 90 per cent of the traffic is still handled by Morse operators on simplex, duplex and quadruplex circuits. It is also interesting to note in the latest arrangements of circuits devised for quadruplex operation a perceptible tendency to revert to the methods employed in the early days of quadruplex telegraphy, such as, for instance, the use of the bridge method of neutralizing the home relays to outgoing signals, the employment of extended magnets on the neutral relay, etc., all resulting in marked improvement in the operation of quadruplex systems. In Canada automatic and printing telegraph systems are but sparingly employed, the use of the manual Morse system being general in that country. This condition prevails quite largely also in Europe, Australia and New Zealand, although in Europe a relatively larger use than elsewhere is made of the Wheat-

stone automatic and telegraph printers of the Bandot, Hughes and Murray type. It may be remarked also that the United States patent rights of the Murray printer have been acquired by the Western Union Telegraph Company, but, according to Mr. Murray, this printer may not be ready for commercial use in this country for some time. The operation of chemical systems has fallen considerably short of expectations, the last instance of this kind being the failure of the so-called telepost. The small independent companies which have undertaken to build up a commercial business with rapid chemical systems have almost invariably been hampered by the lack of adequate line facilities to avoid serious delays and interruptions to service attendant upon wire failures. But even in Great Britain, the birthplace of chemical automatic telegraphy, that system has not been employed in commercial service for over forty years. The original Morse telegraph system, after half a century of use, still exists as the most general means of handling telegraph business virtually the world over. The well-known simplicity, flexibility and reliability of the Morse telegraph system as compared with printing and other telegraph systems, requiring as it does only a key, relay and sounder, probably explains its continued employment throughout the world. Without doubt the general adoption of the typewriter by Morse operators for the printing of received telegrams has also exerted a strong influence for the retention of this system.

Consolidation of Telegraph and Telephone

The consolidation of the Bell Telephone interest with the Western Union Telegraph Company has been followed by a merger of many telephone and telegraph offices and has also led to a wider use of the telephone for the local delivery and collection of telegrams. The number of telegrams already handled in this way by both of the large telegraph companies in the United States probably exceeds 1,200,000 per annum. Apart from the economies effected by the joint use of offices by the telegraph and the telephone in many cities and towns and general co-operation between these different methods of communication, the one naturally adapted for long distance, the other for shorter distance communication, great advantage must accrue to the public by placing within reach of the telegraph numberless hamlets and villages already reached by the telephone but which are too small to maintain a separate telegraph office.

Cable Telegraphy

In submarine cable telegraphy, while the mileage has steadily increased throughout the world, the type of cable laid and the methods of transmission and reception of telegrams have undergone little change in recent years. The automatic transmission of business over cables by means of perforated paper strips and a mechanical transmitter somewhat similar to the Wheatstone transmitter is almost general. In some instances repeating relays are employed at cable stations and in others a method is in vogue whereby the messages are automatically perforated on a paper strip as received from the land wires by Wheatstone, and the strip is then passed through another perforating instrument that automatically translates the Wheatstone perforations into the characters required for cable transmission. In transatlantic submarine telegraphy there has recently been effected a closer traffic arrangement than has hitherto existed between the so-called Western Union group of cables and the Western Union Telegraph Company, whereby these cables are now under a common operating control with the Western Union land lines, to the material advantage of the cable service. A similar arrangement, it is known, has always existed in the case of the Mackay group of cables and the Postal Telegraph Company, and this is generally acknowledged to be one of the principal factors in the success of that company. The immediate result of the new Western Union control has been the inauguration of reduced cable rates for deferred service.

Commercial Wireless Telegraph Development

By John Bottomley

IN a commercial sense wireless telegraphy has made greater progress in the year 1912 than during any previous twelve months. In many respects the course of wireless telegraphy is following the corresponding early development of both the telephone and telegraph. The early days of reckless financing and unfair competition were not conducive to healthy growth and stability. The year just ended has witnessed the exit in bankruptcy or through the activity of the Department of Justice of all but those few concerns that were engaged in the wireless business on a legitimate commercial or experimental basis.

Legislation

It would be unfair in considering the development of the past year in wireless telegraphy to omit mention of the sinking of the White Star liner *Titanic* and the part played by wireless telegraphy in the rescue of passengers. While there was a tendency at first to criticise the wireless service, more sober thought, fortified by actual information instead of circumstantial newspaper evidence, eventually gave to wireless telegraphy that appreciation which it deserved. The result after a very careful Congressional inquiry has been the enactment of a federal law enforcing the installation of an efficient auxiliary transmitter and the carrying of two licensed operators on passenger vessels, as well as a statute placing all wireless stations under the control of the United States Department of Commerce and Labor. While it is true that the laws enacted are not ideal and that more deliberate action would undoubtedly have produced a better result, it must be admitted that the lanes of the ocean have been rendered safer and that now if one would travel without fear he may well select an ocean voyage rather than a railroad journey. Not only have those vessels covered by the law been fitted with wireless equipments, but large numbers of owners of freighters, tugs, barges and other cargo carriers have also caused their vessels to be equipped with this modern method of communication. It is common experience for a line installing a first equipment to find that, instead of involving an added expense, wireless telegraphy really saves its cost many times over in ordinary operation, while it is impossible to estimate its value during emergencies in saving life and property. During the year over 200 vessels have been equipped with wireless telegraph apparatus, and the instances where life and property have been saved have become so common as no longer to require relating in detail.

Operation

From the operating point of view the principal development of the year in wireless telegraphy has been an increase in the power used rather than any well-defined difference in method. The experience of past years, gained by the expenditure of large sums of money and persistent effort, has opened up the way for the use of high-powered apparatus to span distances over which it was formerly thought impossible to communicate commercially during day and night.

Owing largely to the glibness with which the public press insists upon printing the freak transmissions accomplished only at night over great distances by stations of small power, the layman gathers the idea that such results may be commanded at will, while as a matter of fact nothing could be further from the truth. To transmit over a given distance at night under favorable conditions is one thing, but to provide a twenty-four-hour night-and-day service under all kinds of adverse conditions is another matter.

America bids fair to lead the way with the first comprehensive chain of high-power stations for oversea transmission, for already thousands of tons of steel are being fabricated for the necessary masts, and the high-powered apparatus is under construction. Before another year shall have passed large stations will be in competitive operation across the Pacific to Honolulu and Japan, and also across the Atlantic by way of one route to Great Britain and by way of another to Norway.

Electric Railway Developments

By H. M. Hobart

THE most significant developments in the railway-electrification situation during the year 1912 have related to the splendid progress made with the high-pressure continuous-current system. While the favor with which this system is regarded is by no means confined to this country, nevertheless at present America has more rolling stock operating with high-pressure continuous-current equipments than has any other country. There is now an aggregate of considerably over 1000 route-miles of American railways either already equipped and operating with the high-pressure continuous-current system or in process of being equipped for such operation. The rolling stock comprises over 500 motor cars and locomotives. Three standard pressures have come into use for these American roads, namely, 1200, 1500 and 2400 volts. The latter pressure has been adopted for the Butte, Anaconda & Pacific Railway. On this road pairs of 1200-volt motors are connected in series and operated from the 2400-volt supply. Although the road is not yet equipped, much of the apparatus has been built and tested.

Direct-Current System

The Washington, Baltimore & Annapolis Railway has now been operated for a sufficient length of time on the 1200-volt continuous-current system to permit of valuable comparisons of the results with those formerly obtained when this road was operated on the single-phase system. The carhouse expenses, which with single phase amounted to 3.72 cents per car-mile, have been reduced with continuous-current operation to 1.37 cents per car mile. The energy consumption has decreased to the extent shown by the following figures: Per car-mile, single-phase with 59-ton cars, 6.54 kw-hr.; continuous-current with 39-ton cars, 3.56 kw-hr. Per (2000-lb.) ton-mile, single-phase with 59-ton cars, 110 watt-hours; continuous-current with 39-ton cars, 92 watt-hours.

The Piedmont & Northern Railway is a typical example of a 1500-volt continuous-current road. The rolling stock comprises six locomotives and thirty-one motor cars. Pairs of 750-volt motors in series are connected across the 1500-volt supply. The system comprises 300 miles of main line.

Although in America there are as yet no instances of continuous-current operation with a pressure higher than 2400 volts, there is already running in England an experimental line employing a continuous-current pressure of 3500 volts. This is a 3-mile section of the Lancashire & Yorkshire Railway. On this experimental line a locomotive equipped with pairs of 1750-volt motors connected in series is in operation. The Lancashire & Yorkshire Railway has for several years operated many miles of its suburban lines with the 600-volt continuous-current system. Renewed attention will naturally be given to this road as the result of this radical experiment with 3500 volts. It is interesting in this connection to note that in 1905 Mr. F. J. Sprague made the following statement: "I am prepared to engineer and carry to a successful conclusion a continuous-current installation at a working pressure, even on a third-rail, of not less than 1500 volts. And I venture further to affirm that 1500 volts is not the limit of practical continuous-current operations."

One of the most important electric railway events which have occurred during 1912 is the decision which has recently been made to electrify some 250 route-miles of suburban and country lines in and about Melbourne, Australia, on the 1500-volt continuous-current system with overhead contact conductors. Messrs. Merz & McLellan were retained by the Victorian government to deal with the situation and the decision to employ the 1500-volt continuous-current system was reached only after carefully considering the best tenders which had been submitted for both the continuous-current and the single-phase systems. For this Melbourne electrification some 500 motor cars and a considerable number of locomotives are required. Thus in magnitude this undertaking eclipses any of the high-pressure, continuous-current systems which have as yet been installed or even projected in America.

On the European Continent there are a good many instances where the high-pressure continuous-current system has been adopted. Several Budapest suburban railways are operated at 1000 volts. A line between Cologne and Bonn has been operated at 1000 volts for several years, and the individual motors are wound for 1000 volts with a single commutator. There are a couple of dozen or more other Continental railways which employ pressures of at least 1000 volts.

An important factor in the situation is found in the fact that high-pressure continuous-electricity equipments have been supplied by most of the leading manufacturers of electric-railway machinery. Messrs. Ganz & Company, of Budapest, Messrs. Thury, of Genf, and Messrs. Krizik, of Prague, have built the apparatus for a score or more of Continental railways. The Allgemeine Elektricitäts Gesellschaft, of Berlin, and Messrs. Siemens-Schuckert, also of Berlin, have shared the task of building the 800-volt equipments for the Hamburg Hochbahn. Messrs. Siemens-Schuckert equipped the 1000-volt railway from Cologne to Bonn. Messrs. Dick, Kerr & Company, of Preston, England, built the 3500-volt apparatus for the 3-mile experimental section of the Lancashire & Yorkshire Railway. In America certain of the high-pressure, continuous-current roads have been equipped by the Westinghouse company. Most of the roads, however, at present employ General Electric apparatus.

Single-Phase System

So far as America is concerned, the only single-phase extensions carried out during the last four or five years have been for the New York, New Haven & Hartford Railroad system. The work done for this railroad has, however, been of an extensive character. Including the Westchester system which has recently been put into commission, and including also the projects now definitely in hand, the New Haven's electrical system may be taken as comprising some

500 miles of single track with about 150 locomotives and motor cars. The New Haven's generating costs are at present high owing partly to the very poor load-factor and the low power-factor. The load-factor will be improved when, as is intended, the freight trains are also hauled by electric locomotives.

The New Haven road in America reminds one of the London, Brighton & South Coast Railway in England. Some 30 route-miles of this latter railway are already electrified on the single-phase system and the rolling stock comprises about fifty motor coaches. The adoption of the single-phase system on the Brighton line has been the subject of much criticism. However, the officials of the road profess complete satisfaction with the results and intimate their purpose ultimately to equip their entire railway for electrical operation. With the exception of two single-phase motor-coaches supplied some years ago to the Midland Railway (and presumably still employed in operating a desultory service on an obscure branch of the Midland Railway), no other single-phase railway apparatus is in use in England. Furthermore, although many of the large main-line railways are at present earnestly engaged in planning for the electrification of important sections of their systems, there is no reasonable indication that any of these railways will adopt the single-phase system. Two of them—namely, the Lancashire & Yorkshire Railway and the Northeastern Railway—have already in operation a large number of trains equipped with 600-volt continuous-current apparatus, and in so far as any departure is made from this system, it would appear that it will be in the direction of merely employing a higher pressure.

On sections of both the London & Northwestern Railway and the London & Southwestern Railway, electrification plans for which have recently been announced, electric trains of the Underground Electric Railways Company of London are already operated, and it is important, in developing a comprehensive suburban system for the London area, that there should be a considerable interchange of running powers among the several railways serving London. The Undeground Electric Railways Company of London already has a very extensive system, comprising large urban and suburban sections in and near London at present aggregating more than 200 miles of track. The entire service is operated on the 600-volt third-rail system, usually with a fourth rail for the return, the track rails being required for the automatic signaling system. In view of all these circumstances, both the London & Northwestern Railway and the London & Southwestern Railway have found it desirable to use the 600-volt system for the first instalments of their electrical service. The first instalments comprise in the case of each railway some 75 miles of track and about 100 motor cars. Each of the two railways is proposing to build a 25,000-kw power house. The London & Northwestern Company's already matured plans involve the early equipment of a further 173 miles of track. There will obviously be nothing to prevent these railways from adopting, on outlying sections, a working pressure of 1200 volts.

Thus the Brighton line in England and the New Haven line in America are the only large main-line railways in their respective countries to employ the single-phase system for a heavy and frequent service of which the suburban passenger traffic is an important component.

Three-Phase System

A railway electrification system which is peculiarly appropriate for an infrequent service of heavy trains, especially for operation over roads with heavy grades, is the three-phase, which has been rather neglected in most countries. In Italy, however, and to a certain extent in Switzerland, a considerable amount of rolling stock is operated with three-phase motors. The only notable instance in America is the Cascade Tunnel section of the Great Northern Railway. The three-phase locomotives there in use are giving entire satisfaction. An important feature of the three-phase system of railway electrification relates to the availability of regenerative operation on down grades. The simplicity and ruggedness of the polyphase squirrel-cage motor, combined with its unrivaled compactness, its non-pulsating torque, and its low weight and cost, should in some cases render it an attractive proposition.

To sum up the matter of systems, it may be stated, with but little likelihood of occasioning any serious disagreement in America or in England, that continuous-current equipment is usually much the most appropriate. It is also evident that by adopting a reasonably high pressure the continuous-current system is, to say the least, at no disadvantage when contrasted with the single-phase system.

Regulation of Public Utilities

By William J. Hagenah

EVERY great economic movement consists of three well-defined stages, namely, first, the period of public protest against existing conditions; second, the period of legislation, and, third, the period of readjustment to the new legal status. The first period in the movement for regulation of utilities supplied the cause for action against the abuses of corporate power, excessive capitalization, franchise scandals and the occasional close relationship between local politics and public-service corporations. The protests of citizens and civic bodies which grew out of this condition crystallized in the public sentiment which marked the second period and was expressed in the public-utility laws of Wisconsin, New York and nearly a score of other states. This was the period of revolution, when radical doctrines were advanced concerning the powers of the state to regulate such corporations, the character of the franchises through which they operated and the limitation of their profits. Though regarding at first with many serious misgivings the public administration of such laws and their effect on the utilities, the industry as a whole, after several years of experience with regulation, has now entered upon the third stage, characterized by its readjustment and adaptation to the legal theory that a utility is subject to public control and to the political theory that the public is capable of regulating utilities.

The year 1912 will not be historic because of the creation of a large number of public-service commissions. Neither will it be remembered for the establishment of any far-reaching doctrine of law or economics. The movement for utility regulation has now passed the legislative stage. The adoption of public utility laws no longer excites national comment because the doctrine of regulation has become so firmly established that an increase in the number of commissions is accepted as but the natural and inevitable extension of a wise public policy. Neither do the provisions of such new statutes attract general attention. The law-makers who in 1907 and 1908 framed the leading public-utility measures of the country constructed so well that the latter-day legislation has largely been fashioned after the laws of such states as Wisconsin and New York.

The work of the public service commissions has continued undiminished throughout the year. Complaints concerning

inadequate service and excessive rates have been frequent, necessitating extensive investigations along engineering and accounting lines. The decisions have to a considerable extent followed the precedents of earlier years and emphasized the correctness of the opinions then advanced. Certain fundamental principles have been more generally recognized and hence more firmly established, notably that competition among public utilities is inconsistent with the theory of a regulated natural monopoly and that the reasonable rates contemplated in utility regulation are predicated upon a rate of return which will encourage the development of business as opposed to the rate of return which falls just short of confiscation of property as judicially defined.

The year 1912, however, will always be of historic importance, not because of the growth of utility control, but because of the more important reason that during this year the substantial results of state supervision which have accrued during the last five years have become generally apparent and the policy of public regulation of utilities recognized as successful. Present conditions give definite promise of the early completion of the third stage of the economic cycle, from which the public utility will emerge greater because of its increased efficiency, more popular because of the diversified ways in which its service has become a public necessity, and more firmly established because of the confidence which it commands and the resulting distribution of its securities among the investors of relatively small means. Less than five years ago the rapid increase of regulatory statutes was regarded with mixed sentiments of fear and approval. The legal power to regulate was recognized, but the ability of a public swayed by misconception and prejudices to lodge such power with men of trained minds and judicial temperament and to create commissions which would occupy positions of dignity and respect not unlike that of a court was seriously questioned. It was feared that capable men could not be secured for such services, that the commissions would become subservient to politics and that capital would grow timid and seek other fields of investment. Events of 1912 have proved these fears to be groundless and have justified the confidence in the public. Unfortunately not all those who possess the power to regulate public utilities are imbued with the judicial spirit which their office demands, and occasionally decisions are rendered which give evidence that considerations of political expediency have not been overlooked. Generally such conditions will be found in the first efforts at regulation, or may be accounted for in the same manner that a popular but incompetent individual is sometimes elected to public office, but on the whole our utility-regulating authorities are composed of men who fairly represent the sentiment of the public, and that sentiment is one which seeks to do justice.

The closing year will therefore be remembered as the period when confidence in public regulation was established, when the justice of regulatory statutes was generally accepted, and when capital frankly sought the profits and the protection which this doctrine affords. No other year in the history of the industry has witnessed such gigantic strides in the development and extension of utility services. The new capital invested in public utilities during 1912 exceeds by far that of any other year. Not only is this true of American capital, but the safety and general attractiveness of the American utility security has appealed to the wealth of Europe, and the present year has witnessed the shipment to this country of funds conservatively estimated to be in excess of $100,000,000 for investment in public utility issues.

Not only has this year been marked by unprecedented activity in the growth of public utilities but it has witnessed the development of the holding company to a remarkable degree. Scarcely a week has passed during the last year that the financial news has not chronicled the formation of some new holding company which has absorbed many scattered utilities and welded them into one great system under a single directing head. Such consolidation has brought to the smaller and scattered plants technical skill which each alone could not command. Capital has been made available for the smaller utilities because of the efficiency resulting from the many hundreds of formerly isolated plants being brought under the control and direction of the most experienced engineers and managers which the industry affords and because of the greater degree of security which a diversified investment provides.

This movement for concentration among utilities so conspicuous in 1912 corresponds to the similar movement in the field of commercial industries during the period from 1897 to 1903. The effect of the industrial combinations in most cases was to increase the cost of the commodities sold. Recent events have shown that whatever profits resulted from the economies made possible through consolidation were not shared with the public but not infrequently formed the basis for additional capital issues. The consolidation of public utilities under the actual or potential supervision of the state has been attended with no such results. It has already been the means of installing the most modern equipment, of greatly bettering the service in small cities and of extending it to cities and communities to which the independent plants would not have ventured, and often this has been accomplished with a reduction in rates. Obsolete and inadequate stations have been reconstructed or abandoned for large new central stations, and hundreds of miles of transmission lines have been constructed to enable the use of such centralized energy. Through the medium of high-tension transmission systems many small settlements along the routes of the lines are being supplied with service equal to that of the larger cities, while in many states this movement has made it possible to extend the benefits of electricity to the agricultural classes.

The rapid growth of the holding company is an expression of utility progress under state regulation. The consolidation of many properties will result in greater uniformity of methods, the standardization of equipment, abatement of discriminations and increase of publicity in operations, all of which simplify the work of regulation. The development and ultimate success of the holding company lies in the direction which utility commissions have sought to enforce, namely, the efficiency and adequacy of the service and the reasonableness of rates. The intelligent management finds that the greatest profits result from a service beyond criticism. The public service commissions recognize that the best service is possible only with rates which yield a return attractive to capital. Courts possessing only judicial powers must regard the question of reasonableness of return merely from the standpoint of confiscation of property. Public service commissions, on the other hand, act as legislative and administrative authorities and under their wider scope of statutory power are enabled to permit a rate of return which will produce the best results for the public and at the same time will properly reward private initiative.

The year 1912 has therefore been one of importance to the public-utility industry as a whole. It has been free alike from instances of corporate abuse inclined to inflame public sentiment and from radical legislation which would discourage development, but it has witnessed the recognition by both the corporations and the public that each is charged with an obligation to the other and that when these obligations are properly respected the public will be assured against exploitation and capital will be safe from confiscation. The immediate future holds forth much work in the continuation of the reconstruction, but so definitely is ultimate success assured that the public utility industry is progressing by rapid strides. The central fact of 1912 has been the public's appreciation of the needs of capital and the increase of the confidence of capital in the public sense of justice.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Transmission Line 245 Miles Long for Ontario

The municipality of Windsor, Ont., has contracted with the Hydro-Electric Power Commission of Ontario for 2500 hp at a rate estimated at not more than $38 a hp-year. In connection with the contract the Hydro-Electric Commission through its chairman has announced its intention of purchasing a right-of-way from St. Thomas to Windsor and to have the transmission line completed within a year. At present the 110,000-volt circuits of the Hydro-Electric Power Commission extend only to St. Thomas, which is 135 miles from Niagara Falls, and the extension to Windsor will be in the neighborhood of 110 miles long, so that when completed the line between Windsor and Niagara Falls will be 245 miles in length, making it one of the longest transmission lines in the world.

Minimum-Wage Discussion at Boston

At the meeting of the American Economic Association held recently in Boston Prof. Henry R. Seager, of Columbia University and president of the American Association for Labor Legislation, read a paper entitled "The Theory of the Minimum Wage." Prof. Seager stated that the economic interest of society requires the payment of living wages to all workers, except possibly children learning trades and defectives who must be treated as wards of the state. In the United States, he said, the great majority of interests pay such wages to the great majority of their employees and starvation wages are found only in exceptional circumstances. The minimum wage will be of distinct economic benefit, in his opinion, in curing the evils of the sweatshop system and the underpayment of female employees in department stores. It would increase the health and efficiency of those employed in these two kinds of institutions. It would also, declared Prof. Seager, put a stop to exploitation by grasping employers and hasten a better distribution of the labor force of the country. Finally, it would compel society to face the problem of caring for the unemployable, through insurance or pensions for those who should not be expected to be self-supporting and through the better distribution and industrial training of those who might be self-supporting. The principal objections to the minimum-wage plan are essentially practical, but the most convincing answer is the fact that several countries are actually making minimum-wage regulations effective.

National Automobile Show in New York

The thirteenth National Automobile Show will be held simultaneously in Madison Square Garden and in the New Grand Central Palace, New York City, Jan. 11 to 25. From Jan. 11 to 18, which is to be known as the Part I period, pleasure vehicles will be shown in both buildings, and from Jan. 20 to 25, known as the Part II period, commercial vehicles will be on exhibition. Accessories will be on display during both weeks. The show is given under the auspices of the Automobile Board of Trade, and the list of exhibitors indicates that at present there will be forty-three makers of pleasure vehicles and 272 accessory concerns at the Garden during the first week, and forty-six exhibitors of complete pleasure cars, twenty-five displays of motor cycles and more than 100 accessory displays at the Palace. During the second week the Garden will house twenty-five companies showing complete lines of commercial vehicles, while at the Palace there will be on exhibition the house models of forty-one truck manufacturers. Both gasoline and electric cars will be on exhibition during both weeks.

Governor Sulzer on Conservation

In his first message to the New York Legislature, on Jan. 1, Governor William Sulzer stated that the question of the conservation of the natural resources of the State and their development and utilization for the benefit of all the people is a matter of vital importance to the commonwealth and demands most careful consideration by the Legislature. He contends that the forests should be preserved by intelligent forestry legislation, the watersheds protected and the powers of the numerous rivers utilized to the utmost. As a people, he said, we have always been proud of our ability to accomplish results and have long boasted of our magnificent heritage of natural resources. During the first period of development, physical energies and intellectual abilities were directed toward utilizing the natural resources of the land and in the haste to achieve immediate results the wealth that seemed inexhaustible was often wasted. When forests were laid waste, lakes and rivers began to shrink, the power problem became more insistent, and conservation became the plain duty of the hour.

New Cable Rates

On Jan. 1 a new schedule of cable rates, as previously announced, was jointly placed in effect by the Western Union cable lines and the Post Office Department of Great Britain. Most important in the new schedule is the twelve-word cable letter which may hereafter be sent to all points in the United Kingdom, Belgium, Holland, Denmark, Austria, Germany, France and Switzerland for 75 cents. This is a substantial reduction from the existing cable letter of twenty words, for which the charge was $1.50. Under the new arrangement 5 cents will be charged for each additional word, and the telegraph company will add a code word designating whether the message shall be telephoned or mailed at the place of delivery without extra charge to the sender. The week-end letter, for which the charge was $1.50 prior to Jan. 1 for thirty words, will hereafter cost but $1.15 for twenty-four words.

All deferred-rate messages to the United Kingdom have been reduced from 12½ cents to 9 cents per word. The deferred-message rate to points on the Continent and also to points in Africa, India, China and Iceland will remain at 12½ cents per word, which is half the regular rate. The new rates, it is said, are the outcome of the agitation to reduce the number of code messages and encourage the sending of messages couched in plain language. These cable messages will be received at local offices of the Western Union Telegraph Company at any time before midnight and will be delivered within twenty-four hours after their receipt.

A. I. E. E. Meetings

A meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York, on Jan. 10 under the auspices of the power station committee. Mr. B. G. Lamme will present a paper on "High-Speed Turbo-Alternators—Designs and Limitations."

The midwinter convention of the Institute to be held in February under the auspices of the standards committee gives promise of great interest. A large number of papers are being prepared under the direction of Dr. A. E. Kennelly, chairman, and under the special supervision of Messrs. B. G. Lamme and C. P. Steinmetz, of the subcommittee on general revision of rules, and Messrs. W. L. Merrill, Charles Robbins and W. H. Powell, of the subcommittee on rating. The convention will close with a reception and dance to be held at the Hotel Astor on Friday evening, Feb. 28.

At a special meeting of the Institute's executive committee on Dec. 18 Mr. Ralph W. Pope was appointed to fill temporarily the office of secretary, owing to the sudden illness of Mr. F. L. Hutchinson.

N. E. L. A. Committees on Energy Transmission

Mr. W. N. Ryerson, chairman of the hydroelectric and transmission section of the National Electric Light Association, has completed the selection of the section committees which will report to the Chicago convention in June. Mr. L. H. Conklin, of Scranton, Pa., will serve as secretary for the section. The list of committees is as follows:

Operation of Transmission Systems—D. B. Rushmore, chairman, Schenectady, N. Y.; J. B. Foote, C. S. Ruffner, J. B. Mahoney, P. W. Sothman, Max Hebgen, C. S. McCalla, R. M. Wilson, J. C. Smith, H. W. Buck, R. S. Kolsch, F. B. H. Paine.

Distributing Lines—P. M. Downing, chairman, San Francisco, Cal.; H. H. Cochrane, W. R. Thompson, Markham Cheever, J. A. Lighthipe.

Receiving Apparatus—M. R. Bump, chairman, 60 Wall Street, New York; L. C. Nicholson, E. A. West, Prof. E. L. Corey, F. Darlington.

Irrigation.—C. H. Williams, chairman, Denver, Col.; L. P. Hammond, O. G. F. Markhus, J. C. Parker, and a representative of the Pacific Gas & Electric Company.

The Electric Truck in New England

At the December meeting of the New England Street Railway Club Mr. Day Baker, president of the Electric Motor Car Club of Boston, delivered a lecture upon the latest advances in electric-vehicle practice, outlining features of the work in New England in particular. Industrial concerns are rapidly learning to appreciate this class of transportation, which appears likely to displace all other forms of trackless service within a radius of 10 miles from the starting point. One of the largest users of electric trucks in New England is the Amoskeag Manufacturing Company, of Manchester, N. H. The installation of this company originally gave a great deal of trouble on account of snow and ice, but as soon as the operators became experienced in handling the machines they found that by the application of chains to the rear wheels and by sanding the roadways where ice had to be overcome the vehicles could be forced to climb any of the stiff grades in the place. Each of the 2-ton machines owned by the company is obliged to make twenty trips per day, the course being up and down a 14 per cent grade. After from four to six years' service the machines are doing their work with the utmost success.

The Pacific Mills at Lawrence, Mass., operate nine electric trucks in their yard service. The company recently stated that in the first two years of service these trucks have saved 22.5 per cent over the cost of horse haulage. Many of the hauls are shorter than 200 yards. With the present increased experience of the truck operators a saving of 29 per cent over the cost of horse service is made. Seven 3.5-ton machines are in use at the Pittsfield (Mass.) shops of the General Electric Company in hauling castings and finished machinery. Twenty-five additional machines will shortly be placed in service in Boston by the American Express Company for short-haul work. The Jenney Manufacturing Company of Boston has found it more profitable to deliver gasoline around town to the local garages by means of two 5-ton electric trucks carrrying twenty-seven barrels each than to use gasoline-driven machines for this service. Mr. Baker also referred to the noteworthy electrification of the Springfield (Mass.) fire department, which is now standardizing on eighty cells of battery to secure suitable speed and interchangeability. The Boston Edison company now has twelve electric roadsters in regular service and some fifteen lamp delivery wagons. The roadsters run about 100 miles per charge and can maintain a speed of 20 miles per hour. Mr. Baker said that in the near future a guarantee of 150 miles in seven hours is to be expected and pointed out that this will enable a man to ride practically all day long at 20 miles per hour.

Court Refuses Long Acre Company Permission to Issue Bonds

The Court of Appeals of the State of New York handed down a decision on Dec. 31 on a writ of certiorari obtained by the New York Edison Company to review an order of the Public Service Commission of the First District authorizing the Long Acre Electric Light & Power Company to issue $2,000,000 worth of bonds. By a vote of four to three, the court decided that the Long Acre company has no power to issue bonds for the purpose of entering the electric-light business in the boroughs of Manhattan and the Bronx without obtaining first a certificate of convenience and necessity from the Public Service Commission.

The Public Service Commission originally denied the application of the Long Acre Electric Light & Power Company for permission to issue securities and also denied a rehearing. Thereafter the Long Acre company caused this determination to be reviewed by a writ of certiorari issued by the Appellate Division of the Supreme Court. That court reversed the determination and referred the application back to the commission for consideration and action. The court said in substance that the reasons for the denial of the application by the Public Service Commission were based on the underlying proposition that there should be no competition in the business of public lighting, as it was the just policy of the State to prevent such competition. The court held, however, that there was nothing in the public service law relating to gas and electric companies to show that the right to determine whether such competition should be permitted had been delegated to the Public Service Commission. In June, 1910, the Public Service Commissions law was amended and the section relating to gas and electric companies was re-enacted so as to give the right to the commission to determine the question of public convenience and necessity. Subsequently the petition of the Long Acre company was considered again by the commission and the New York Edison Company appeared as an interested party under the amendment of 1910 to show that the franchise claimed to be owned by the Long Acre company was never operated and used according to law and also to show that no public necessity exists for a competing company. The commission granted the application of the Long Acre company against the objection of the New York Edison Com-

pany, and the latter thereupon applied for a rehearing by the commission, which was denied. The New York Edison Company appealed to the court, with the result that by a divided opinion the Appellate Division upheld the authorization of the issue of $2,000,000 bonds on certain conditions.

The New York Edison Company then took the case to the Court of Appeals, with the result stated above. The Long Acre company will now have to apply for a certificate of convenience and necessity from the Public Service Commission and meet the arguments of the New York Edison Company to the effect that corporations subject to the prevailing public-service regulations cannot at the same time be subject to competition. The New York Edison Company contends that if it is to be regulated in the present manner it should be protected by the State against competition and that if competition is to be permitted it should be relieved of such regulation and allowed to meet competition in competitive districts at competitive rates.

The Long Acre company was incorporated to manufacture and distribute electricity in the boroughs of Manhattan and the Bronx and could put poles, wires and conduit on and under the streets with the consent of the municipality. It did not apply to the Public Service Commission for permission to construct its plant, claiming that its right to do so is superior to the restrictions imposed by the Public Service Commissions law.

Government Suit on Retail Price Agreement

On Dec. 26 the federal Department of Justice filed suit at Detroit in the District Court of the United States for the Eastern District of Michigan, Southern Division, against the Kellogg Toasted Corn Flake Company and its officials, of Battle Creek, Mich., alleging violation of the Sherman law. The specific violation charged by the government is the agreement imposed by the Kellogg company on the jobbing trade to sell toasted "corn flakes" contained in a patented package at a fixed price per case and in requiring the retailers to sell the product to ultimate consumers also at a fixed price per package. According to reports, the Department of Justice officials say that this suit is a test case and that it is the first suit of the kind in which the government centers its attack chiefly on agreements requiring jobbers and retailers to sell at fixed prices. It is alleged that the Kellogg company advises the jobbers that if they fail or refuse to observe the fixed price they will be cut off from further supply and, furthermore, gives the retailers to understand that they must sell each carton and its contents at 10 cents per package or also have their supply cut off. The defendants, according to the government's allegations, have invoked the patent laws and seek shelter under the general right to impose restrictions upon the sale or use of patented articles, as upheld, for example, in the Dick case.

The government alleges that the Kellogg company obtained by assignment a patent issued on March 19, 1912, to John F. Byrne for a carton, application having been filed Nov. 6, 1911, or about four months earlier. These cartons, in which a food product called "corn flakes" is distributed and sold, are alleged each to bear the following restriction:

"This package and its contents are *sold conditionally* by us with the distinct understanding, which understanding is a condition of the sale, that the package and contents shall not be retailed, nor advertised, nor offered for sale at less than 10 cents per package. Retailing the package at less than 10 cents per package is a violation of conditions of sale and is an infringement on our patent rights, and renders the vendor liable to prosecution as an infringer."

The plaintiff alleges that the carton was not in fact patentable, in that all its features were old; that the value of the carton is insignificant compared with its contents, the later being the thing wanted by purchasers while the carton is purely incidental; that when the defendants sell a carton and its contents they part with all legal title thereto and violate the act of July 2, 1890, in imposing restrictions thereon.

To the layman it seems clear that the principle established by the majority opinion of the United States Supreme Court in the Dick case can be extended so as to cover apparently such a case as this one, even though the food product or commodity contained within the package has no relation nor any apparent effect upon the patent covering the package or container itself. The position taken by the defendants seems to give ground to the fears which were raised by the Dick decision, that the unbridled right to impose all sorts of restrictions on patented articles would lead to commercial abuses of the most burdensome and serious character. This case raises sharply the issue whether the patent laws can be invoked as an adequate defense for acts which would otherwise clearly be in violation of the Sherman law. The course of this suit will therefore be followed with the utmost interest and a decision awaited with much eagerness.

Federal Investigation of the American Telephone & Telegraph Company

Attorney General Wickersham has recently informed a representative of the *Electrical World* that the government's investigation of the methods of the American Telephone & Telegraph Company and its numerous subsidiaries is practically completed and that a decision has been reached as to whether a suit should or should not be instituted against the company. What decision he had reached he would not state, but indicated that when the new administration takes over the reins of authority in the Department of Justice it will find itself confronted with much new big business. It is now frequently rumored in Washington that the Attorney General has finally decided to bring suit against the "telephone trust," alleging violation of the Sherman law.

Mr. Wickersham has now before him a mass of data in relation to the case which has been accumulated by special agents of the Department of Justice following months of investigation which covered the whole country. These reports make a record almost as voluminous as that in the Standard Oil case. The chief point which is now said to be under consideration is that of determining whether or not the Bell interests have restrained trade in an illegal manner. This involves the whole matter of telephone and telegraph service throughout the country, and many interwoven questions of a complex character, such as whether the Western Union Telegraph Company is using patents in restraint of trade. If the latter complaint reaches the courts, there is said to be involved a new interpretation of the patent law relating to a highly complicated situation.

The business relations of the Bell company with the Western Union Telegraph Company form one of the subjects into which the reports of the special agents are known to have gone in detail, including the practice of connecting with the Western Union Telegraph Company any person calling by telephone and desiring to send a "telegram." Alleged difficulty on the part of telephone subscribers and the public generally in securing connection with the offices of the Postal Telegraph Company is another matter under investigation. The reports deal, furthermore, with the alleged attempts of the Bell interests to secure a monopoly of the telephone field through buying out independent telephone companies throughout the whole country, but particularly in the Middle West, where the independent companies flourished in great number some years ago but are now disappearing.

Oregon Electrical Contractors' Association

State supervision of electrical installations, closer co-operation between contractors and central-station men and better systems of credit and cost analysis were the topics of the first annual convention of the Oregon Electrical Contractors' Association, held at Portland, Dec. 17 and 18. Business sessions occupied the first day, and on the second the members of the convention were taken to the Estacada power plant of the Portland Railway, Light & Power Company. Later an election of officers was held, and in the evening the annual banquet took place. On Dec. 19 there was a rejuvenation of the Sons of Jove.

The sessions of the convention were attended by contractors from all parts of the State, the audience at times numbering nearly 200. Tuesday's opening session was held in Moose Hall, the address of welcome being made by Mr. Gus Mosier, of the Portland bar. Mr. J. H. Ralston, retiring president of the association, replied in well-chosen words, mentioning the importance of the contracting business to the electrical industry at large.

Mr. George H. Duffield, of Utica, N. Y., special representative of the National Electrical Contractors' Association, opened the program, outlining the history and growth of the national association and showing its value to the contracting industry of the country. The association was organized about twelve years ago with only a few members, and it now has over 1200. It issues a great deal of matter of value to contractors and supplies information on accounting, standardization, etc. Mr. Duffield stated that in his travels he found about two-thirds of the manufacturers are standardizing their manufactured goods, resulting in great advantage to the contractors. Mr. Duffield next discussed the question of price standards, bringing out questions from the audience relative to prices on the Pacific Coast and why they should be higher than in the East.

PRESIDENT-ELECT R. G. LITTLER

Mr. F. D. Weber, of the Underwriters' Equitable Rating Bureau, who followed, said that the Underwriters' attention was forcibly called to the necessity of electrical inspection in 1881 by the occurrence of a number of electrical fires in the textile mills of New England. Immediately local rules were formulated, and from these grew the National Electrical Code, which was first adopted as such in 1896. The Underwriters have endeavored with the aid of other national organizations to set a standard below which no workmanship or material should fall. In connection with the present work there are maintained in Chicago the Underwriters' Laboratories, Inc., which now dispense labels at the rate of 20,000,000 a year.

The things to consider in devising a system of inspection are, said Mr. Weber: (1) The amount of labor required to place the defects under a system—in the field and in the office. (2) Flexibility of the system regarding addition of new defects and the addition of new buildings. (3) Simplicity of the office system, so that one not an electrical engineer can find the defects on any risk. (4) Simplicity and ease of understanding for the layman as well as for the electrical contractor. (5) Avoidance of mistakes on the part of the layman and contractor by double meaning being attached to any defect pointed out. (6) Return of proper certificate of correction, signed by the proper party, as owners' or tenants' signatures cannot be accepted. (7) Ability of formal notice to make the proper impression on owners and tenants, so as to get the corrections made immediately without forcing them by rate adjustment. (8) A method of protecting owners and tenants from the operation of dishonest contractors, by having the contractors' statements of proper correction in writing. (9) Division of responsibility between the contractor, local city inspector and bureau inspector for proper correction. (10) Means by which to adjust rates without inspection, thereby giving honest correction of defects the advantage of the best rate possible, without at the same time nullifying the original notice.

After luncheon, Mr. F. N. Averill, manager of the Fobes Supply Company, spoke on the relation of the electrical jobber and the electrical contractor, urging them to work hand in hand in seeing that proper material is installed so that the electrical business shall not fall into disrepute.

Mr. O. B. Coldwell, general superintendent of the power and light department of the Portland company, offered some practical statements as a central-station man, and dwelt upon the feature of co-operation, declaring as essential to the business interests of the electrical industry that jobbers, contractors and central-station men should always work in close harmony with one another.

An address on municipal inspection followed by Mr. Howard Joslyn, city electrician of Seattle, in which he described the system in use in his city and how effective it has grown to be. The public at large, he insisted, would become much less fearful of accidents resulting from the use of electricity if it knew that electrical work was installed and inspected properly during construction.

Mr. L. B. Smith, a local commercial credit manager, spoke on credit and its utility in the modern commercial world. Closely bearing on the same topic was a paper by Mr. P. L. Proctor, manager of the Pacific Audit Company, in which the author discussed cost and efficiency. Mr. Proctor urged contractors to keep accurate and complete books, so that they might know exactly how much it cost to handle a given piece of work. This practice, he declared, would not only increase the efficiency of their operations but would put them in a position where they could submit bids and estimates with the full knowledge that they would be able to do the work at the price mentioned and at a profit.

On Tuesday evening the contractors were entertained at a vaudeville show. On Wednesday morning 125 members of the convention boarded a special trolley car to the Estacada power plant, located 35 miles southeast of Portland on the Clackamas River. After inspecting the station, a luncheon was given at the Estacada Hotel, Mr. J. E. Werlein, special agent for the Portland company, acting as toastmaster.

Returning to Portland, an election was held at which the following officers were chosen for the ensuing year: President, R. G. Littler, Portland; first vice-president, H. D. Lakoro, Portland; second vice-president, W. H. Baker, Eugene; third vice-president, John Vaughn, Pendleton; fourth vice-president, L. E. Dawson, The Dalles; secretary, F. C. Green, Portland; treasurer, J. R. Tomlinson, Portland; national director, R. G. Littler; executive committee, H. E. Knight, Portland.

In the evening a banquet was held at the Multnomah Hotel, and on Thursday evening there was a rejuvenation of the Sons of Jove, when forty-two were initiated.

Federal Land Grants Held Up

By joint action of the War, Interior and Agricultural Departments on Dec. 28 extensive land patents of the International Power & Manufacturing Company, of the State of Washington, were held up on the ground that the company was attempting to free itself from all government control by securing patents to lands under the guise of mining claims or by railroad scrip filings in combination with a special dam license. It is said that the company was planning to build a series of hydroelectric plants, which it is estimated would produce 200,000 hp, having an annual value of upward of $5,000,000. The power sites are in the so-called "Z" Canyon of the Pend d'Oreille River, situated partly in the Kaniksu National Forest and partly in a power-site reserve set aside by President Taft. Secretary of the Interior Fisher charges that many so-called mining schemes have been located along the river in the National Forest and within the power-site reserve, but no attempt seems to have been made to press the mining claims for patent, the company apparently relying upon the special act licensing its dam. The plans filed with the War Department show that the company will use the public lands in the National Forest for flowage and public lands in the power-site reserve for the same purpose, and also for a right-of-way for conduits and sites for the power houses. The mining claims had been previously acquired by the Pend d'Oreille Development Company, which also obtained scrip land from the Northern Pacific Railway and later sold both to the International Power & Manufacturing Company. Secretary Fisher characterized these cases as an example of the methods used to defeat federal ownership.

New York State Hydroelectric Scheme

At the last session of the New York Legislature a bill was introduced by Senator Bayne providing for a state-wide scheme of hydroelectric development and high-tension transmission under state ownership and operation, for the purpose of selling electrical energy to municipalities and the public. The proposed act was introduced as an amendment to Chapter 647 of the Laws of 1911, entitled "An act relating to the conservation of land, forests, waters, parks, hydraulic power, fish and game, constituting Chapter 65 of the Consolidated Laws." It was proposed to repeal Article VI thereof and enact a new article in its place covering the general project just mentioned. The provisions of the new article stipulated the general powers and duties of the State Conservation Commission, which would be charged with the administration of the scheme. The character of service to municipal corporations, contracts for distribution, purchase or construction of distribution plants, construction of transmission lines, the letting of construction contracts, appropriation of property and other allied matters were covered in the fourteen sections of the act. In view of the extensive scope and far-reaching effect of such a scheme if carried through, and in further view of the agitation in favor of it carried on by the Conservation Commission since the adjournment of the last Legislature, it seems worth while to give our readers some account of his proposed undertaking and the arguments advanced in its behalf.

General Features of Proposed State Project

The scope of this state-owned hydroelectric undertaking was described in a recent issue of the *Engineering Magazine* by Mr. A. H. Perkins, who since 1909 has been engaged with the State Water Supply Commission and the Conservation Commission. In its general features the proposal is quite similar to the hydroelectric system recently completed by the Province of Ontario and now operated under the management of the Ontario Hydroelectric Commission.

It will be recalled that a committee of the last Legislature made a trip to Ontario for the purpose of inspecting the system in operation there and obtaining first-hand information in reference to its advantages. The Hon. Adam Beck, chairman of the Ontario commission, also gave testimony regarding the system before the legislative committee at the State capital.

In order that the original proposal contained in the Bayne bill may be compared with the Ontario system, the map of the New York scheme has been reproduced from Mr. Perkins' article on the same scale as a second map showing the Ontario high-tension distribution system. It will be apparent at once that the proposed New York system is much more extensive than the Ontario plant. According to statistics advanced by Mr. Perkins, the present total rating of primary power plants of all sorts in the State of New York is approximately 4,000,000 hp; of this, 2,200,000 hp is developed in central station and railway generating plants, 1,200,000 hp is generated in steam power plants situated in industrial establishments, and 700,000 hp is developed from water-powers utilized in manufacturing industries. At the present rate of growth the power requirements of the State will be 5,000,000 hp in 1915 and 7,200,000 in 1920. The present installed rating of steam power plants in the State is now therefore about 3,300,000 hp, but Mr. Perkins estimated that no more than 2,500,000 hp of this total could be replaced by hydroelectric power, owing to the use in some instances of waste products for fuel and also to the use of large amounts of steam in certain industrial processes, making it possible to obtain steam-generated power as an inexpensive by-product. He estimated that the total diversity factor of the different individual demands for the whole State would not exceed 50 per cent, thus requiring but 1,250,000 hp of installed hydroelectric capacity.

In connection with the map of the proposed high-tension distribution system, which shows also the location of the proposed generating station, the installed rating of each hydroelectric plant and the estimated requirements for steam auxiliaries in each instance are given in Table I. These nine developments have a total estimated hydroelectric rating of 1,669,000 hp, with a total of 809,000 hp in steam auxiliary plants, and a peak load rating of 2,153,000 hp.

TABLE I.—RATING OF HYDROELECTRIC PLANTS AND PROPOSED STEAM AUXILIARIES

	Rating of Hydroelectric Plant.	Auxiliary Steam Plant.	Peak Load.
Niagara River	380,000	380,000	760,000
St. Lawrence	461,000	200,000	500,000
Canal System	105,000	25,000	105,000
Genesee River	115,000	15,000	125,000
Salmon River	35,000	5,000	40,000
Black River	30,000	15,000	30,000
Raquette River	150,000	80,000	170,000
Oswegatchie River	20,000	10,000	20,000
Hudson River	373,000	79,000	403,000
Totals	1,669,000	809,000	2,153,000

Mr. Perkins pointed out that the economic and legal problems arising in connection with a proposed development of this magnitude are very difficult. In justification of the general scheme the following clause was quoted from the title of the 1907 act: "To devise plans for the progressive development of the water-powers of the State for the public use under state ownership and control." The platforms of both political parties contained similar declarations in the 1910 elections, and since that time the chief executive of the State and the Conservation Commission have both labored for the realization of such a State project as that contemplated in the Bayne bill land here described.

Under the title "Cheap Electricity for All" the State Conservation Commission has distributed copies of a little pamphlet intended for popular consumption, setting forth in question and answer form its reasons for advocating the construction of a comprehensive hydroelectric system under state ownership and management. This prospectus is of considerable interest and its principal statements have been abstracted here in order to reveal fully the reasons for such a tremendous project as that which the people of the State have had placed before them. The commission makes at the outset the sweeping statement that there is enough undeveloped water-power in the State now going to waste to furnish light in every house and supply power to every factory. The utilization of this power, it is declared, will cut monthly electric bills in half and make electric cooking cheaper than the time-honored coal range. Again it means the stimulation of industry and employment for more men and women. This vast power, being the people's property, should be developed for their benefit.

Undeveloped Water-Power of the State

The undeveloped water-power is said to be about 1,500,000 hp, of which the greatest amounts are at Niagara Falls and the Long Sault Rapids in the St. Lawrence River. Three companies are developing hydroelectric energy on the Canadian side at Niagara, paying the Canadian government a large sum yearly for the privilege, and selling energy in Canada at about half the price charged in New York State for energy proceeding from the same source. Two companies operating on the New York side pay our own government nothing for their privileges. About 250,000 hp additional can be developed at Niagara without impairing the scenic grandeur and later on still more can be developed by the use of more efficient machinery, more favorable locations and regulating the flow of the river. About 1,000,000 hp is developed at the Long Sault, but only part of this would belong to the State.

In 1907 the New York Legislature granted the entire rights to the Long Sault site to a company controlled by the so-called "Aluminum Trust," which is said neither to have yet done anything toward actual development nor to have obtained the necessary consents of the Ontario authorities or the United States government. This grant is declared to be the greatest single power grant to a single company in a single place on record and the greatest power monopoly in the State. It is furthermore said to be under investigation by the Attorney-General of New York.

By building storage reservoirs on the watersheds of the principal rivers, such as the Hudson, the Genesee, etc., the flood waters could be controlled and much additional power developed as the result of more uniform stream flow. The State also owns about 85,000 hp developable along the Erie and Barge Canals, from water by-passed at the locks, and at dams and locks in tributary rivers and lakes. The State now actually owns, in the Barge Canal, in reservoir sites and stream beds, about 400,000 hp. In regard to the rest of the undeveloped power, it will be necessary for the State to resume the right to develop these powers by revoking the franchises granted by the Legislature to various companies, which, so far, have done nothing toward development, and reimburse them for actual financial outlays.

It is proposed to develop these water-powers one at a time, as the demand arises, and transmit the energy therefrom to municipalities at actual cost. This energy will then be retailed at actual cost for public, domestic and commercial service of all kinds. The municipalities, by vote of the citizens, will enter into power contracts with the State at fixed annual prices. Thirty-year State bonds will be sold to pay for the hydroelectric generating and transmission system. Each contracting municipality will pay annually such proportional part of the cost of building the State system as will cover the interest, the sinking fund to retire the bonds, the depreciation, the maintenance and the operating expense. The municipal payments will thus cover the bond interest and retire the bonds at maturity. Furthermore, each municipality will finance the local distribution and delivery of energy to its customers by similar bond issues, under the same general plan. Citizens will contribute nothing toward this project in way of direct taxation, but each municipality will pay the established rates for public lighting, which will be covered in the general tax levy.

The commission declares this plan will halve the cost of house lighting, greatly reduce the cost of public lighting, and also halve the cost of factory power and motive power for transportation systems, all with greater efficiency than is possible under private ownership. Taking hard coal at $6.50 per ton and gas at 80 cents per 1000 cu. ft., in New York, electric cooking will be less expensive. In Ontario electric energy competes with 60-cent gas for cooking. It is even promised that energy will be so cheap that manufacturing can be successfully carried on in workmen's homes, if desired. At present, it is said, the small user of power is discriminated against and made to pay a big price. It is also promised that this scheme will make New York the world's manufacturing center, building up factories in rural districts and relieving city congestion. The scheme, so the commission says, will save $15,000,000 annually to electric consumers in ten of the principal cities and conserve 20,000,000 tons of coal per annum. The small communities will be on equal footing, as regards rates, with the densely populated districts.

It is proposed to build a great trunk transmission line along the Barge Canal from Niagara Falls to Albany and thence to New York City, with loops to every municipality in the State. The project will be successful, it is argued, because of what has already been accomplished in Ontario under a like plan. The latter system is declared to have been operating in Western Ontario for two years and in Ottawa for seven, with an interruption of not to exceed thirty seconds in that time. Over 300 miles of high-tension lines serve thirty cities under contract, and 100 more applications are pending. That system is also declared to be financially successful and to have cut rates in half. Ninety-nine per cent of the houses in Ottawa are lighted by means of this cheap energy, where one inhabitant in every five uses electricity, compared with one in twenty in Albany and one in thirty-five in New York City. In Ontario the ordinary small house is said to pay $1 per month, whereas a fourteen-room house with thirty lamps pays $2 per month on the average. The commission says these are one-half the New York prices.

In Ottawa the rate for continuous power is $22.50 per hp per annum and less for summer season service and for restricted use. In Toronto, 90 miles from the Falls, the city purchases continuous power at $18.50 per hp and sells ten-hour power at $28 per annum. In London, 138 miles from the Falls, the city buys at $28 and sells at $40 per hp; whereas in Albany eight-hour power costs $45 per hp up and in Buffalo, 22 miles from the Falls, the city pays $25 per hp. The private companies in Ontario were arrogant in the extreme toward the small consumer, so the commission says, before the government system was established, but that has all passed. Nearly all of the private companies in Ontario are declared to have profited by state competition and enlarged their business, instead of suffering any loss, financial or otherwise. By comparison with state or municipal waterworks and electric-light plants, there is nothing socialistic in the proposed state-wide hydroelectric system. Water-power is a natural monopoly in itself and should be in the people's hands.

The commission claims that under private ownership the proposed scheme would not carry nearly the same measure of public benefits, even under the present administration of the Public Service Commissions law. The case of Buffalo is cited in proof of this contention, as follows:

"Niagara Falls was to make Buffalo the great power city

of the country. By adroit corporation jugglery Buffalo is supplied by local companies with power generated by Canadian companies. It has appropriated $35,000 for hearings before the Public Service Commission to get relief from unreasonable rates, and it is claimed by the power interests that the Public Service Commission has no power to regulate

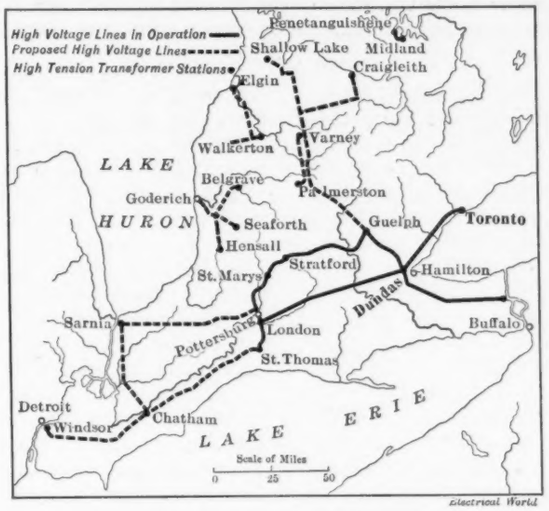


FIG. 1—MAP OF TRANSMISSION SYSTEM OF HYDROELECTRIC POWER COMMISSION OF ONTARIO

prices at Buffalo because it has no jurisdiction over the price paid for power by the local distributing companies. State regulation of price cannot be either cheap, expeditious or effective, because it is generally true that the stock of most private power companies is entirely water, and yet, being in the hands of innocent purchasers, it cannot be interfered with."

At the third annual conference of mayors of New York cities, held in Utica June 10, a strong resolution was unanimously adopted recommending such a state-wide system. The federal control of water-power in Switzerland is also cited, as well as the municipal and state ownership in Germany, where electric energy is in greater use on the farms than in any other country of the world. The large hydroelectric developments in Norway and Sweden are cited, and it is stated that Winnipeg has built its own hydroelectric system and furnishes electric energy for cooking at the low rate of 1 cent per kw-hr., or one-tenth the price charged for similar service in New York State. Hydroelectric systems owned by the cities of Chicago, Los Angeles and Seattle also come in for mention. It is denied that politics would creep into the handling of the proposed New York project or diminish its efficiency in any respect, and the successful handling of other large government projects is quoted in the resolution in substantiation of this contention.

On March 14 last the Commissioner of Corporations, then Mr. Herbert Knox Smith, transmitted to the Secretary of Commerce and Labor a most important report on "Water-Power Development in the United States," with special reference to concentration of ownership and control. Out of about 6,000,000 hp of developed water-power in the whole United States, there are some 4,000,000 hp in developments of 1000 hp or over, and of the latter class a total of about 700,000 hp is situated in New York State. On the basis of 75 per cent efficiency in development, without storage, the revised estimates of the Geological Survey credit New York State with a potential water-power of 1,037,000 hp minimum and 1,698,000 hp assumed maximum. The undeveloped water-power owned by concerns having 1000 hp or over was given as 193,000 hp; this included no power at the Long Sault Rapids of the St. Lawrence. The Aluminum Company of America was credited with 48,000 hp developed at Massena, on a canal from the St. Lawrence, and 48,000 hp undeveloped.

Under the 1910 treaty Canada may divert 36,000 second-feet at Niagara and this country 20,000 second-feet. The total is approximately 25 per cent of the river flow, as computed by government engineers, and if fully developed would be about equivalent to 1,300,000 hp. On the American side the Hydraulic Power Company of Niagara Falls has an installation of 144,000 hp (and 20,000 hp undeveloped) and the Niagara Falls Power Company has 118,000 hp, making a total of 262,000 hp. On the Canadian side there are four companies, with 238,000 hp installed, or a grand total of 500,000 hp of installation. All the energy generated on the American side and considerable of that on the Canadian side is sold in this country. In this connection it may be noted that Mr. Perkins assumed a 300-ft. head at Niagara as possible, in estimating a total development of 540,000 hp from 20,000 second-feet, and allowed for only 160,000 hp of present installation in reaching the conclusion that 380,000 hp is still undeveloped.

Closing Comments

The Bayne bill received the support of the Governor and passed the Senate, but was not reported in the Assembly. It appears on the face of the matter that the State project would be independent of the two Public Service Commissions and that enforced competition with central-station companies now operating in the State would be inevitable, whether warranted or not. No estimates of cost under the proposed scheme either as to investment, annual charges or service rates have been circulated among the taxpayers, who are bound to accept the final responsibility. There

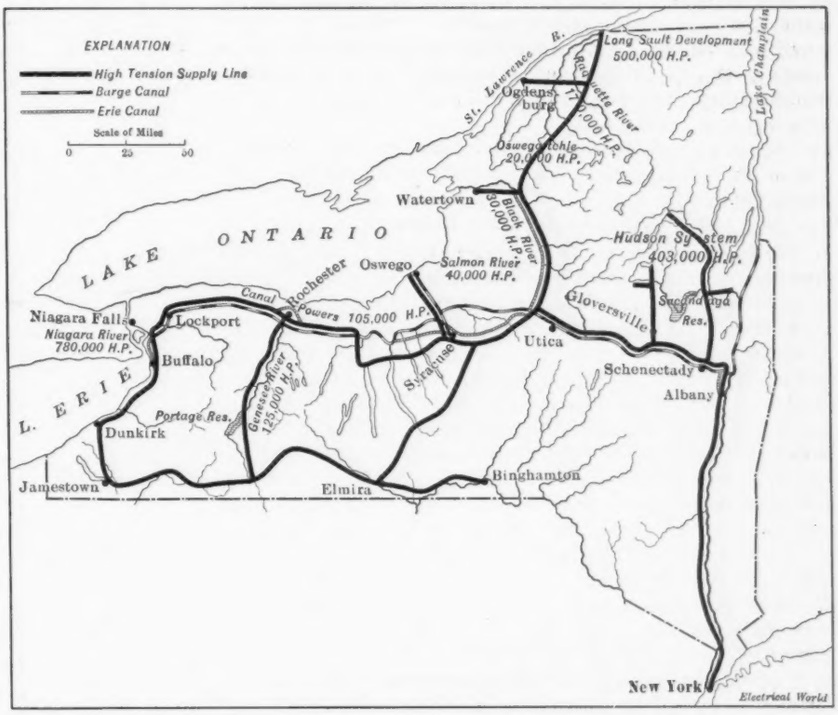


FIG. 2—PROPOSED HYDROELECTRIC SYSTEM FOR NEW YORK STATE

seem also to be legal questions in connection with the titles to some of the proposed water-power sites yet to be settled, involving perhaps litigation or even international arbitration. The plans from an engineering standpoint, so far as announced, are also in very rough form and the estimates of power available are apparently open to revision. Control of the flood-waters of the principal streams in the State involves so many serious questions that details of each proposed development should be made public and scrutinized with great care. There is need for going slow with such a vast undertaking as this one discloses itself to be.

Public Service Commission News

New York Commission

The Public Service Commission, Second District, has authorized the New York Telephone Company to put into effect Jan. 1, 1913, new rates for general telephone service in Dunkirk City. The reductions in the annual rates will be for business direct line $12, two-party line $18, and for residence direct line $9, two-party line $6, four-party line $8. The rate for farm lines served by such central office for residence service is reduced $3.

Connecticut Commission

The first annual report of the Connecticut Public Utilities Commission, covering the period from Sept. 9, 1911, to June 30, 1912, recommends enactment of laws giving the commission jurisdiction over mergers of public-service companies and the right to exercise closer scrutiny in general. The commission made the following declaration of principle in relation to the use of surplus earnings:

"We believe that the net income and profits of any public-service company, after the payment of reasonable dividends, should be used for the improvement of the plant and equipment of such company, rather than in unwarranted expansion or the acquisition, management and control of business and property more or less foreign to the chartered purposes of the parent company."

The commission also recommended an investigation of the condition of the water supply of the State and its conservation.

New Jersey Commission

The New Jersey Board of Public Utility Commissioners has just handed down one of the most important decisions of its comparatively brief existence, ordering a reduction of the gas rates charged by the Public Service Gas Company in the Passaic division from $1 net per 1000 cu. ft. to 90 cents per 1000 cu. ft., effective on and after Feb. 1. The board also recommended that the company make the same reduction throughout all of the other divisions in the State where it is now charging the net rate of $1. In determining the valuation upon which the gas company should be allowed a reasonable return the board allowed $1,025,000 to cover intangible property, including organization, franchises, cost of establishing the business, etc., whereas the company claimed a value of $3,091,000. Nothing was allowed for "good will." In respect to "going-concern value" the board decided that a public-utility company can have an excess in value over and above the value of its tangible property, or, in other words, a plant with a business attached is of greater value than the mere plant without the business. In respect to franchises the board stated that the present policy of the State is not to allow the capitalization of franchises for an amount in excess of the actual cost involved in obtaining them. The decision states that the 90-cent net rate will afford a return of approximately 8 per cent on the value of the property as found by the board. This rate of return is not a precedent to be applied indiscriminately to other cases. The board further decided that securities issued in mergers, as was done in this case by the Public Service Corporation, are not a proper basis for rates. The company contended that the par value of securities originating in the merger of six different gas and electric concerns in this district in 1899 determines an amount below which the board's aggregate valuation should not fall. This contention was expressly denied by the board, which held that the capitalization resulting from the consolidation was in excess of the real assets.

Massachusetts Commission

The Gas and Electric Light Commission recently gave a hearing upon the petition of the Gardner Electric Light Company for an increase of capital stock by 800 shares. A feature of the hearing was an extended discussion of the practice of flat-rate incandescent lighting with excess indicators as conducted by the company. Mr. J. D. Whittemore, local manager, stated that the usual price of 1 cent per watt of connected load per month applied to residence lighting service in the Gardner district, the customer also having a choice of meter service if desired. The majority of contracts are made for four 25-watt tungsten lamps. Feeders are metered at the station, there being no meters on the individual flat-rate services. The amount of flat-rate energy sold is estimated on the basis of 10 cents per kw-hr., the line losses being estimated by subtracting the sum of the total estimated input to flat-rate installations and the total metered input from the combined readings of the switchboard feeder meters. The percentage of error introduced in this way is small, as the number of flat-rate installations is still a small proportion of the total lighting installations. The company maintains a flat rate of 1¼ cents per watt of demand per month to stores open not later than 10 p. m. and not more than three nights a week. A charge of 3 cents net is made for all-night lighting by doctors. The company recently purchased 285 5-amp, 110-volt excess indicators at $2,565, thirty 10-amp indicators at $270 and five 25-amp indicators at $70, transit, oil, freight and cartage adding $127.

Among the cost data presented at the hearing was the expense of building a 66,000-volt spur line 16.8 miles in length from the Connecticut River Transmission Company's trunk line to South Barre, the items being as follows: Right-of-way, 100 ft. wide, and land damages, $9,368.64; 579 40-ft. chestnut poles with 14-in. butts and 9-in. tops, including rigging, stringing wire and clearing of right-of-way, $23,041.35; four special steel towers for railroad crossing, erected, $993.58; wishbone steel cross-arms (6-ft. equilateral triangles), $3,202.93; high-tension insulators and pins, $5,224.89; phase wires, three No. 6 copper-clad steel, 40 per cent conductivity, $2,616.42; ground wire, one No. 6 copper-clad, 40 per cent conductivity, $870; telephone wires, two No. 10 copper-clad, 30 per cent conductivity, $593.16; ground wire insulators and pins, $87; telephone insulators and pins, $161.45; sectionalizing disconnecting switches, $505.50; junction tower, $121.61; surveys, engineering, inspection, testing and superintendence, $4,799.44; telephone apparatus, $276.52; miscellaneous, $315.61; total, $52,148.10, or $3,104 per mile.

Maryland Commission

A demurrer to the petition for an injunction to restrain the Public Service Commission and the Chesapeake & Potomac Telephone Company from taking out the flat-rate telephones in Baltimore was filed last week in the Circuit Court by the telephone company through its attorneys. Mr. William Cabell Bruce, chief counsel, on behalf of the commission, demurred to the petition several days ago. The petition was filed by certain members of the Maryland Telephone Protective Association and others.

Ohio Commission

Application has been made by the Lima Telephone & Telegraph Company, Lima, for permission to purchase the Central Union Exchange in that city. The price agreed upon is $205,000. This application was accompanied by a

similar one from the Central Union Telephone Company. The purchasing company also seeks authority to issue $500,000 in bonds, of which $205,000 will be used to pay for the Central Union exchange and the remainder to liquidate debts and make improvements. The Lima Telephone & Telegraph Company is capitalized at $150,000. This is perhaps the largest consolidation that has been effected between Bell and independent companies since the enactment of the public service law and the creation of the commission. The hearing will take place on Jan. 22. It has been announced that rates for business lines will be increased from $3.50 to $4 per month, and there are prospects that the consolidation will be vigorously opposed before the commission for this reason. It is said the number of subscribers will be increased to 7000.

The Dayton Power & Light Company has applied for permission to issue $100,000 preferred and $49,750 common stock to be exchanged for $100,000 Xenia Gas & Electric preferred at par and $99,500 common at 50. This will give the Dayton company the entire stock capitalization of the Xenia company. It has two large plants and is reaching out to larger territory. The acquisition of the Xenia property will open up a good market for its surplus energy.

Oregon Commission

The Railroad Commission of Oregon has issued calls for conferences with various public utilities throughout the State, this being its first act toward regulation of utilities as provided in the law passed by the people in November. On Friday, Dec. 27, a conference with electric power and light and street-railway companies will be held at Salem, and on Dec. 28 a conference will be held with gas, water, telephone and telegraph companies at the same place.

California Commission

The city of Palo Alto, Cal., after voting the control of its utilities to the California Railroad Commission, complained against the rates of the Palo Alto Gas & Electric Company. The defendant applied to the Superior Court of Santa Clara County for a writ of prohibition to prevent the commission from proceeding to hear the case, contending that the city trustees of Palo Alto had already fixed the rate for the ensuing year and that the Railroad Commission could not act until the end of that year. The decision of the Superior Court sustained the Railroad Commission, enabling it to proceed with the hearing.

The commission has decided to conduct a series of tests in the induction cases in which the Pacific Telephone & Telegraph Company complained of serious interference with the operation of its telephone lines by induction from high-tension transmission lines in proximity to its wires.

Current News and Notes

EXPLOITATION OF FINLAND WATER-POWERS.—According to a recent report, the water-powers of Finland are to be exploited by a Belgian company with a capital of $6,000,000.

* * *

TELEPHONE PENSION SCHEME GOES INTO EFFECT.—On Jan. 1 the pension plan of the American Telephone & Telegraph Company and its subsidiaries, as previously announced on page 1028 of our issue of Nov. 16, became effective. A ten-million-dollar fund has been set aside to provide for the payment of benefits.

* * *

GOVERNMENT INVENTORY OF CALIFORNIA WATER RESOURCES.—The results of the work undertaken by the United States Geological Survey in compiling an inventory of the water resources of the State of California are being published in six volumes, designated as Water Supply Papers 295-300 inclusive, notice of several of which has already appeared in these columns. The first three volumes are gazetteers and the last three contain the results of stream-flow measurements.

* * *

GREATER NEW YORK RAILROADS AND STREET RAILROADS KILL ONE VICTIM PER DAY.—Reports of accidents on railroads and street railroads in Greater New York for the month of November, 1912, as made to the Public Service Commission for the First District, show that the total number of accidents was 5783, against 5291 in November of last year. Of these accidents, 3651 involved injuries to persons, against 3221 in November, 1911. The number of killed was 32, against 31 in November of last year, and the total number of serious injuries was 192, against 216.

* * *

INCREASE IN PATENT APPLICATIONS.—In his annual report the Commissioner of Patents, Mr. Edward B. Moore, gives the receipts of the office for the fiscal year ended June 30, 1912, as $2,094,059, compared with $1,987,778 for the previous year. The number of applications for patents for inventions aggregated 69,236, against 65,154 for the fiscal year ended June 30, 1911. The commissioner recommends the establishment of the Patent Office as an independent bureau of the government and also that a new building be erected, the present quarters being overcrowded and the records in danger of destruction by fire.

* * *

LONG SAULT WATER-POWER GRANT DECLARED VOID.—In an opinion rendered by Attorney-General Carmody to the New York State Senate at Albany, Jan. 1, the charter granted by the Legislature of 1907 and signed by Governor Hughes authorizing the Long Sault Development Company to utilize the Long Sault Rapids in the St. Lawrence River is declared to have been unconstitutional. No power has yet been developed by the owners of the franchise, which recently passed to the control of the aluminum interests. Mr. Carmody holds that the grant contravenes the section of the constitution inhibiting the passage of private privileges or franchises, and also that it infringes on the state forest-preserve laws.

* * *

THE INVENTORS' LEAGUE OF AMERICA ORGANIZED.—An organization which has tentatively adopted the name "The Inventors' League of America" was recently formed at a meeting of inventors held at the Stevens House, 21 Broadway, New York City. Two meetings of the new organization have already been held. At the second meeting there was a general discussion of ways and means for raising funds to protect inventors against those who are seeking unfairly to exploit their brains and labor. It was decided to draw up a prospectus and circulate this among prospective members and others generally interested in the movement. The temporary president of the league is Mr. George Whigelt, and its membership includes Prof. P. W. Nelson, of Pratt Institute, and Messrs. Edward S. Gleason, Herman D. Sears, Charles E. Smith and M. J. Langan.

* * *

WESTERN UNION TELEGRAPH COMPANY SECURES INJUNCTION AGAINST LOUISVILLE & NASHVILLE RAILROAD.—On Dec. 28 the federal court at Louisville, Ky., granted the application of the Western Union Telegraph Company for an injunction to prevent the Louisville & Nashville Railroad from removing the telegraph company's equipment from the road. It is said that the Western Union Company will now push its suit to condemn a right-of-way along the railroad. Following the announcement of the injunction counsel for the railroad company asked that the Western Union Company be required to furnish a bond for $250,000 to cover possible damages and alleged indebtedness for right-of-way rental amounting to $110,000 for the last three months. Action on this request was deferred. The present controversy between the companies dates from the expiration last August of a contract for reciprocal service.

SOCIETY MEETINGS

Electrical Jobbers' Convention.—The annual convention of the Electrical Supply Jobbers' Association will be held at the Lafayette Hotel, Buffalo, N. Y., on Feb. 11, 12 and 13. The secretary of the association is Mr. Franklin Overbaugh, 411 South Clinton Street, Chicago Ill.

* * *

Wisconsin Electrical Association.—The fifth annual meeting of the Wisconsin Electrical Association will be held at the Hotel Pfister, Milwaukee, on Jan. 15 and 16, 1913. The annual dinner will take place on the evening of the first day. Mr. Irving P. Lord, of Waupaca, is president of the association, and Mr. George Allison, Stephenson Building, is the secretary-treasurer.

* * *

N. E. L. A. Company Section in St. Louis.—At the December meeting of the Union Electric Company Section of the National Electric Light Association in St. Louis, Mr. J. F. Dechant, of the Sheldon School of Chicago, gave an address on "The Science of Business Building." Instrumental music was furnished by the Union Electric Orchestra, while the Glee Club of the company sang several selections.

* * *

Annual Meeting of the Illuminating Engineering Society.—On Friday evening, Jan. 10, the Illuminating Engineering Society will hold its annual meeting at the Aldine Club, Fifth Avenue Building, Twenty-third Street and Fifth Avenue, New York. A dinner at 6:30 p. m. will precede the annual business meeting, which will commence at 8 o'clock. Members who cannot attend the dinner are urged to make an effort to be present at the business meeting. Chairman C. Alfred Littlefield anticipates an interesting and enjoyable evening on this occasion. Those desiring to attend the dinner should make reservation not later than Jan. 8 through Mr. Littlefield at 55 Duane Street, New York.

* * *

Los Angeles Section, A. I. E. E.—On Dec. 17 100 members of the Los Angeles Section, A. I. E. E., the Electrical League and the local Architects and Engineers' Society listened to a lecture on "Light, Color and Illumination," by Mr. W. D'A. Ryan, of the General Electric Company, who was in the West in connection with the lighting of the twin expositions at San Diego and San Francisco in 1915. The speaker was introduced by Mr. George A. Damon, chairman of the Los Angeles Section, A. I. E. E., and spoke on the subject of colors, lighting effects, light sources, the illumination of Niagara Falls, the Hudson-Fulton celebration and the Panama Canal, telling also something of the plans for the lighting to be used at the California expositions in 1915. The lecture was illustrated with many lantern slides.

* * *

Economic Associations Convene at Boston.—The American Economic, Historical, Political Science and Statistical Associations, the American Sociological Society and the American Association for Labor Legislation held a joint convention at Boston from Dec. 27 to 31, which was largely attended by industrial and political economists from all parts of the continent. Among the features of the program were a discussion of the "Minimum Wage," opened by Mr. H. R. Seager; a study of the "Relation Between Statistics and Politics," by Mr. Leroy D. Pavey, of Babson's Statistical Organization; "The Rising Cost of Living," by Prof. Irving Fisher, of Yale University, and papers on training for industrial efficiency by Messrs. C. A. Prosser, H. G. Valentine and others. Former President Theodore Roosevelt was the chief speaker at one of the early sessions, and an aftermath of the gathering was a joint open meeting on Jan. 1 of the Special Libraries Association, Eastern District, and the Boston Co-operative Information Bureau, whose program included visits to the libraries of Stone & Webster, Arthur D. Little, Inc., the Boston Society of Civil Engineers and other working book and periodical collections.

* * *

American Society of Agricultural Engineers.—At the sixth annual meeting of the American Society of Agricultural Engineers, held in Chicago on Dec. 26, 27 and 28, a new constitution was presented and discussed. The object of the society is to promote the art and science of engineering as applied to agriculture, and considerable attention is devoted to the economical use of energy in farming operations. The testing of gasoline tractors, for instance, had a prominent place in the program of the Chicago convention. Prof. H. W. Riley, of Cornell University, president of the society, occupied the chair. In his opening address he recommended the establishment of standards and said that one of the features of agricultural engineering is the designing of machinery that will run in spite of the ignorance of the operator. None of the papers discussed related to electrical subjects. Prof. L. W. Chase, of the University of Nebraska, Lincoln, Neb., was elected president, and Mr. I. W. Dickerson, University of Illinois, Urbana, Ill., secretary.

* * *

West Penn Electric Company Activities.—Covers were laid for fifty-six persons at the fourth annual banquet of the West Penn Electric Company, held at Greensburg, Pa., Dec. 11. At the regular monthly meeting preceding the banquet Mr. W. R. Kenney, superintendent of lighting, presided, later turning the meeting over to District Superintendent Snite. Papers were read by Mr. E. I. Barnard on "Electric Motors Versus Gas Engines," and by Mr. L. T. Jackman on "Meter Reading and District Work." With Mr. Kenney as toastmaster, responses were made by Messrs. E. D. Dreyfus, statistician; H. P. Chambers, superintendent of lighting, and T. S. Henderson, manager of the new-business department, all of the Pittsburgh office, and by Mr. F. A. Moesta, district superintendent at Kittanning, and Mr. W. S. Anderson, chief clerk of the Connellsville office. A score of towns in western Pennsylvania, in which the West Penn Electric Company operates, were represented, including Brownsville, Connellsville, Uniontown, West Newton, Scottdale, Latrobe, Monongahela, Charleroi, Greensburg, Washington, Canonsburg, McDonald, Kittanning, Butler, Waynesburg, Leechburg, Saltsburg, New Kensington and Sewickley.

* * *

Annual Meeting of the Efficiency Society.—The Efficiency Society will hold its annual meeting at 29 West Thirty-ninth Street, New York City, Jan. 27 and 28, and the following program has been announced: On Monday, Jan. 27, following the president's address a business meeting and election of officers will be held, a symposium on organization, discussion on the necessity of charts of organization, symposium on management, discussion on democracy in industry and "securing the consent of the governed," and in the evening a dinner at the Aldine Club, after which will be held a symposium on efficiency in the government organization, national, state and municipal, and a discussion on a readjustment of the governmental departments. Tuesday's program includes a symposium on industrial relations, a discussion on the relations between employer, employee and the community, and in the afternoon a symposium on industrial hygiene and safeguards against occupational disease and accident, and symposiums on safety in marine and land transportation, crowded buildings, city conflagrations, forest fires, mines, dam-protected districts and freshet floods. This last session will be illustrated by moving pictures and lantern slides demonstrating the efficiency obtained by conserving the human element in industry. The meeting will close at 5.30 p. m., following the final business session. The secretary of the society is Mr. H. J. F Porter, and the headquarters are at 29 West Thirty-ninth Street, New York.

New Terminal Post Office in New York—I

Electrical and mechanical equipment, wiring and illumination of the government building over the Pennsylvania Railroad yards. By L. B. Marks and J. E. Woodwell

IT is safe to say that the average man has very little realization of the intricate problems involved in the design of the electrical and mechanical equipment of a huge modern post office building. To the average man such a building merely represents an enlargement of a smaller building and means simply more floor area to provide for additional employees and increased business.

The fact is, however, that with the increase of post office facilities engineering problems not involved in smaller buildings arise. The handling of a few thousand pieces of mail is a simple matter, but the handling of many millions of letters and parcels each day with accuracy and celerity is a complicated problem, involving the consideration not only of electrical and mechanical machinery adapted to handling an enormous business but also a study of the special problems of heating and ventilation, electric lighting and installation of motors, elevators, etc., which come into play in the case of large establishments.

The general idea of a large post office is perhaps that it is a big office building for housing a large number of clerks who will receive and distribute the mail, whereas such a building is more likely to be a gigantic machine, with complicated mechanism for automatically handling hundreds of tons of material daily, with all the refinements of modern engineering devices.

The engineering problems in such a building become all the more important when taken in connection with the terminal facilities of a great railroad station, and as the new United States Post Office in New York City is directly connected with the Pennsylvania Railroad Terminal, the problem of handling the mails involves most careful consideration of the terminal facilities and the co-ordination of the work of the Post Office Department with that of the railroad company.

Post Office Building

Erected of Milford granite in Roman-Corinthian style of architecture, extending 375 ft. from Thirty-first to Thirty-third Street, with its principal façade and approach on Eighth Avenue, the building is perhaps the most imposing structure of its kind in the country. A broad flight of steps spans a colonnade of twenty columns bearing Corinthian capitals, extending along Eighth Avenue from the north to the south pavilion. For the erection of the building, of which Messrs. McKim, Mead & White are the architects, Congress appropriated $4,500,000, approximately $800,000 of which will be expended for the electrical and mechanical equipment including the mail-handling facilities at the Pennsylvania Terminal. It is not unlikely that the total volume of business in the building will eventually represent the equivalent of an average of over 5,000,000 pieces of mail matter daily—about double the present amount. The building is the largest terminal post office in the United States and is the headquarters for the postal service of the city of New York. It occupies a site over the Pennsylvania terminal yards and contains five floors and a basement.

FIG. 1—NEW U. S. POST OFFICE OCCUPYING TWO CITY BLOCKS, VIEWED FROM EIGHTH AVENUE AND THIRTY-THIRD STREET

Both the terminal station and the new post office building span the tracks of the Pennsylvania Railroad, 50 ft. below the street level. Mail bags are sent through spiral chutes or elevators down to a trucking subway extending under the tracks nearly 1000 ft. To facilitate the rapid transfer of mail from point to point on the various levels and through the elaborate system of subways, a large number of electric motor trucks have been provided, each having a carrying capacity of 4000 lb., and plunger elevators between the different levels have been designed of sufficient size and capacity to raise and lower these trucks.

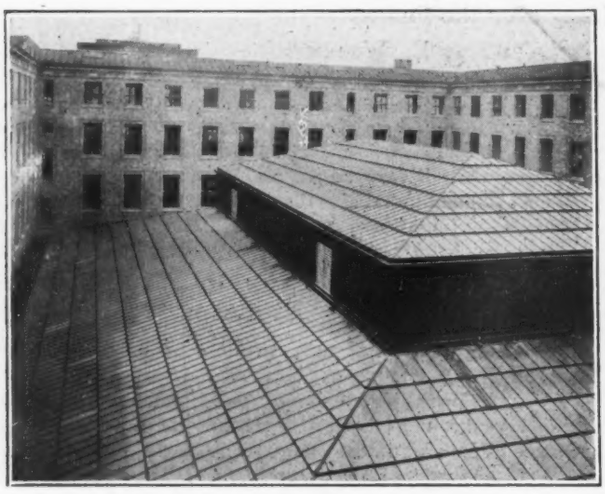


FIG. 2—UPPER SKYLIGHT OVER MAIN WORKROOM ON FIRST FLOOR, COVERING 33,000 SQ. FT. OF FLOOR AREA

Such facilities, however, are not of themselves adequate to provide for the prompt handling and dispatch of the enormous quantities of mail—250 to 300 tons, comprising from 12,000 to 16,000 bags, weighing from a few pounds to 300 lb. apiece—which daily depart from and arrive at this station. Since the trains are moving quickly in and out of a very restricted underground trackage network, this immense mass of mail must be handled with great celerity.

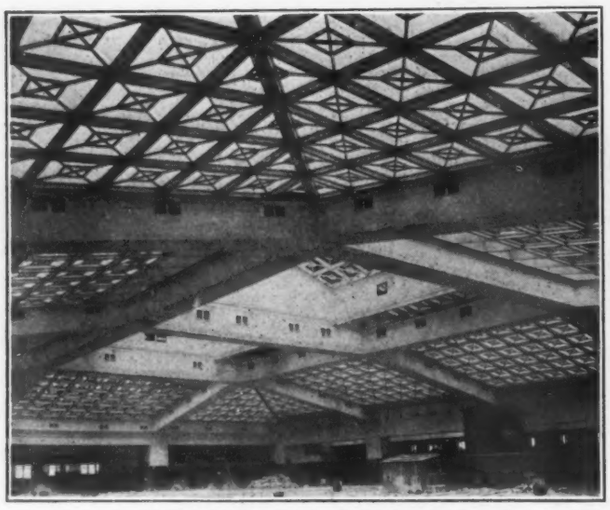


FIG. 3—VIEW IN MAIN WORKROOM; 33,000 SQ. FT. OF FLOOR SPACE UNDER ONE SKYLIGHT

Therefore a mechanism had to be devised which would be not only capable and reliable in operation but would embody such dimensions as to go into a space cramped in the nature of things by the building structure itself—the latter being virtually a monumental traffic gateway straddling the underground railway tracks. The mechanism referred to had to be free of all possibility of causing delay in train movements or interfering with lines of sight on signals. In other words, a complex conveying machine had to be installed in waste underground space that had already been reduced to the lowest practicable amount by the railroad and building architects. A general pictorial section of the terminal mail-handling installation and equipment is shown in the accompanying illustration.

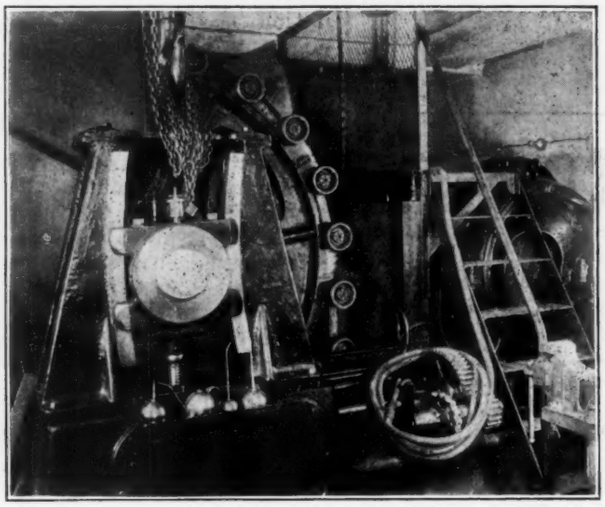


FIG. 4—BUCKET LIFT FOR ELEVATING INCOMING MAIL FROM PENNSYLVANIA RAILROAD TRAIN PLATFORM TO BUILDING

GENERAL DATA POST OFFICE BUILDING

Length of building north and south, ft.	375
Length of building east and west, ft.	335
Height from basement to roof, ft.	109
Gross cubic contents of building, cu. ft.	11,000,000
Total interior floor area, sq. ft.	500,000
Area of mailing platform, sq. ft.	9,800

The working zone for handling mail in the post office building comprises two narrow spaces on the first floor at basement levels extending north and south and spanning the Pennsylvania Railroad tracks below reserved for the postal cars.

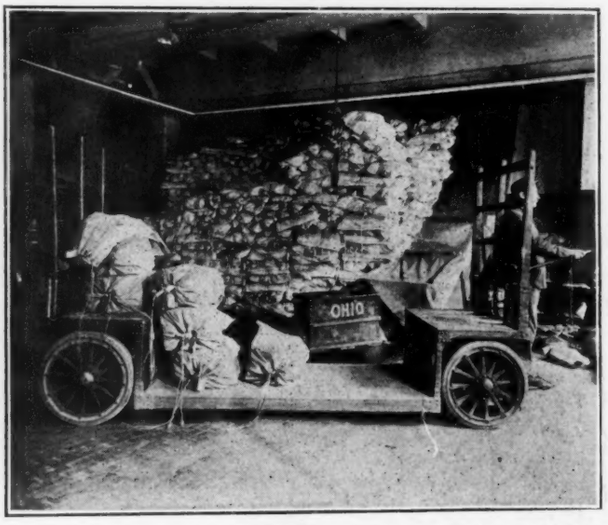


FIG. 5—STORAGE-BATTERY TRUCK, CAPACITY 4000 LB., SPEED 6 MILES PER HOUR

The railroad mail service, coincident with the operation of the Pennsylvania railroad and train service, began at

the new terminal on Nov. 27, 1910. Four train platforms and six tracks, providing for a maximum of twenty-six mail cars at one time, were set apart for the railway mail service.

Two classes of machinery are provided, one for handling the outgoing and one for handling the incoming mail. The mail to be dispatched on departing mail trains arrives at the station in wagons which are unloaded on the mailing platform. Here the mail pouches are sorted, some of them being sent to the basement level through spiral chutes, where they are opened and the contents re-distributed and finally re-pouched. The reassembled pouches, together with the unopened pouches, are then fed into spiral chutes which deliver them to conveyor belts located over the track platforms and above the mail cars, and also to the trucking subways. The belts are provided with automatic trippers or unloading mechanisms, which may be set opposite the door of any of the cars of the mail train, thus automatically unloading and transferring the mail through parabolic slides directly into any one of the mail cars for which the apparatus has been set. Two belt conveyors are provided over each of the four mail track platforms, one belt extending east and one west of the connecting spiral chutes, which are constructed with separate compartments, one for each belt. By this means two mail cars at each of the four track platforms may be loaded simultaneously by machinery.

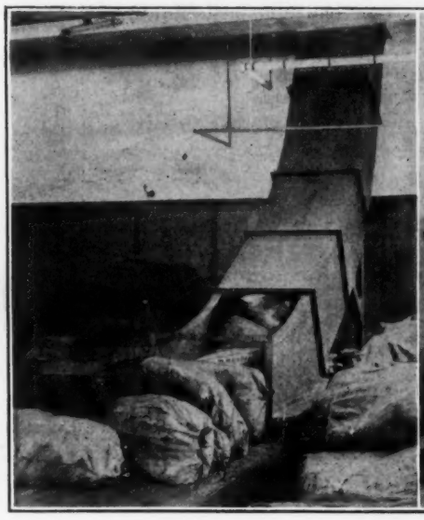


FIG. 6—NEWSPAPER SLIDE FOR CONVEYING BAGS FROM FIRST FLOOR TO BASEMENT

FIG. 7—CHUTE FOR DIRECTING THE MAIL INTO THE WAITING CARS

FIG. 8—BELT CONVEYOR OVER TRACKS FOR AUTOMATICALLY UNLOADING BAGS FROM BELT INTO CHUTE

The accompanying diagram gives a key to the arrangement of the mail-handling machinery and shows a section looking east and a section looking north. Another diagram shows a side elevation and plan of belt conveyor and bucket lift for handling the incoming mail. The illustrations show the bucket lift for elevating the incoming mail from the

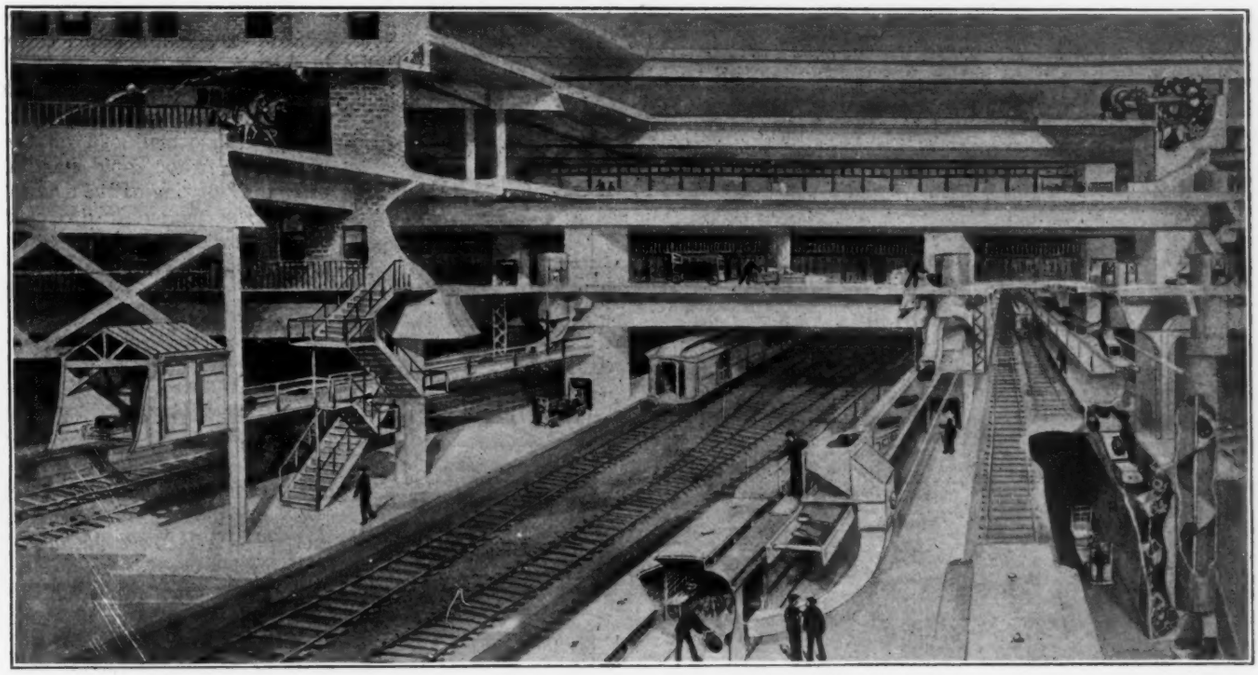


FIG. 9—GENERAL PICTORIAL SECTION OF THE MAIL-HANDLING INSTALLATION AND EQUIPMENT IN OPERATION AT THE PENNSYLVANIA TERMINAL

train platform to the basement and first floor of the post office building; the belt conveyor over the tracks for automatically unloading the bags from the belt into the chute leading directly to the cars; a view of this chute; a newspaper slide for conveying the bags from the first floor to the basement; a view of the assembly of the driving mechanism of the bucket lift, and a general view from the track yard at the rear of the post office building, showing the mail conveyor structures in process of erection.

The supports for overhead belt conveyors, driving motors, etc., are hung on the overhead framing of the post office building above the limits of train clearances, being so disposed as to avoid interference with lines of sight of train signals.

One of the salient features of the work was a fourfold system of spiral chutes. This system was grouped into double, triple and quadruple chutes, with single chute compartments designed for simultaneous loading at the different levels without interference.

The problem of designing suitable chutes was rendered extremely difficult by reason of the wide variation of loads, ranging from that of the small and practically empty canvas bag to a full bag of periodicals weighing as much as 300 lb. The spiral curves are so designed that the speed and certainty of delivery of bags of the two extremes in weight and size is regulated or controlled by centrifugal force.

There are eight overhead belt conveyors for outgoing mail. The motors for these are of the semi-inclosed type, designed for 650 volts direct current and arranged to secure a speed control of 20 per cent above normal speed by shunt-field control and a decrease of 20 per cent below normal by added armature resistance. The motors are capable of developing the following rated horse-powers when operating at a maximum speed of 20 per cent above normal:

Track platform No. 4: West belt, 73 ft. long, 5-hp motor; east belt, 185 ft. long, 7.5-hp motor.

Track platform No. 8: West belt, 65 ft. long, 5-hp motor; east belt, 195 ft. long, 7.5-hp motor.

Track platform No. 13: West belt, 192 ft. long (two belts in series), 10-hp motor; east belt, 60 ft. long, 5-hp motor.

Track platform No. 14: West belt, 192 ft. long (two belts in series), 10-hp motor; east belt, 60 ft. long, 5-hp motor.

The motors have drum-type non-reversible compound controllers, no-voltage, overload and push-button release features. The individual motor drive for each of the belts consists of two reduction mechanisms between the motor and the conveyor belt-driving pulley. The first reduction mechanism between the motor and the countershaft consists of a Reynolds silent chain, and the second reduction between countershaft and driving pulley is made with spur gears. The entire drive is rigidly mounted upon the structural members supporting the conveyors. The bearings of the countershafts and the driving pulleys are of the self-aligning, ring-oiling type with renewable bronze shells and cast-iron pedestals. The spur gears are of cast steel with cut teeth of extra wide face, and the pinions are of forged steel cut from the solid. Beneath each motor is placed an oil-tight galvanized-iron drip pan.

A hand lever operates the controller for bringing each motor to the desired speed. In case of abnormal load on the motor due to too rapid starting or to the clogging of the driving mechanism, the overload release coil will cause a solenoid switch to be opened, and this switch will not close again until the controller lever has been returned to the "off" position. Push-button release stations are located along the gangway of the conveyor structure for the respective belts at intervals of approximately 40 ft. By pressing a button at any one of those stations, the release coil becomes energized and causes the main-line solenoid switch to be opened in the same manner as for the overload device. In the event of failure of the supply of energy the no-voltage release feature is brought into action, opening the main-line solenoid switch, which protects the motor from inrush of current should the supply be restored before the controller handle is moved to the "off" position.

The only manual operation required is the setting of the motor-operated tripper and the insertion of its spout into the door of the car. The stream of pouches then pours in at the door of the car, there to be stored away.

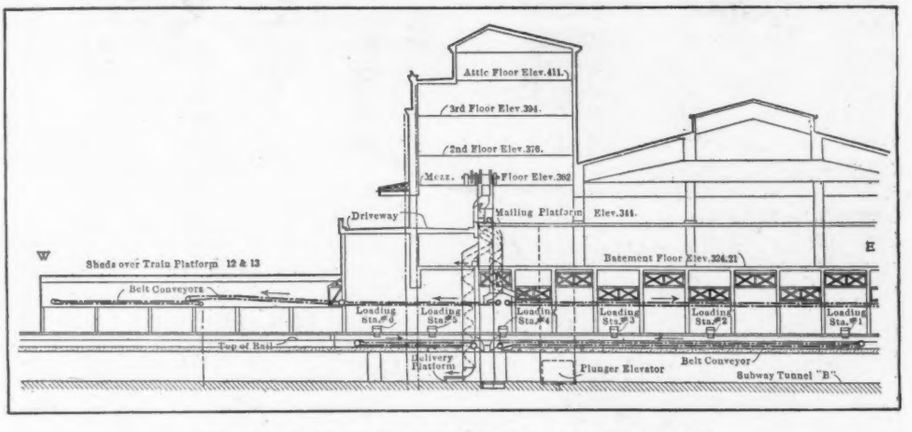


FIG. 11—SECTION OF POST OFFICE, LOOKING NORTH

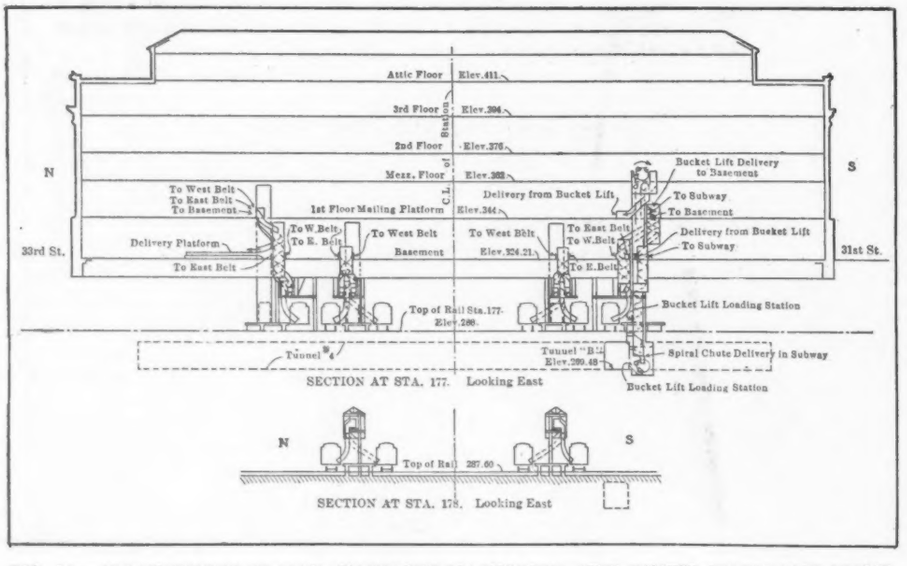


FIG. 10—ARRANGEMENT OF MAIL-HANDLING MACHINERY, NEW UNITED STATES POST OFFICE AND PENNSYLVANIA TERMINAL

The motor drive of the bucket lift includes a combination of spur and bevel gears, reducing the speed of the 650-volt, 50-hp motor from 150 to 4 r.p.m. for the head shaft and the main driving sprockets.

The bucket lift motor is equipped with a magnetic self-starting controller fitted with "no-voltage," "overload" and "push-button release," one at the train-platform level and the other located near the motor.

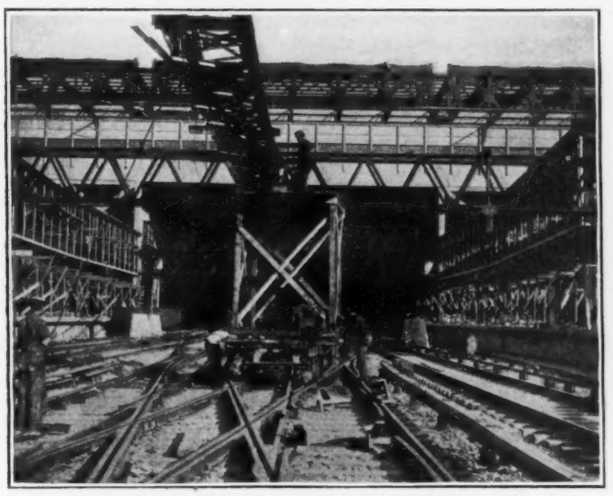


FIG. 12—GENERAL VIEW FROM TRACK YARD AT REAR OF POST OFFICE BUILDING, SHOWING MAIL-CONVEYOR STRUCTURES IN PROCESS OF ERECTION

In addition to the two operating stations mentioned, release push-buttons are located at the train platform convenient to the automatic loading stations for shutting down the machinery in case of emergency. Immediately above each of the manual loading stations and the loading stations of the bucket lift are installed U-shaped pivoted bars extending around the front and sides of the path of the buckets, so that any mail pouches protruding beyond the front edge or sides of the bucket will raise the bars, which in turn will close a switch connected with the push-button release circuit, thus shutting down the machinery and preventing damage to the mail sacks or machinery. The bucket elevator can handle 1200 bags an hour.

There are two sources of energy supply for operating the mail-handling motors, one consisting of separate feeders from the main switchboard in the power plant, terminating in a distributing tablet located in the transverse tunnel below the track level. This distributing panel is fitted with switches and separate feeders to each of the four groups of conveyor motors. The other source of supply consists of a connection taken from the third-rail operating the train service, the feeder connecting to a distributing panel, on which is mounted a double-throw switch. This insures uninterrupted service for the conveyor motors.

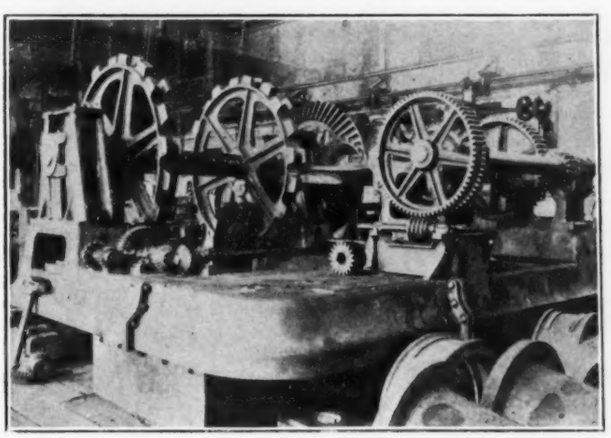


FIG. 13—ASSEMBLY OF DRIVING MECHANISM OF BUCKET LIFT

Operation of Mail-Handling Equipment

Some idea of the speed of the mail-handling apparatus may be gained by watching the loading of one of the heavy Western mail trains which carries the early morning newspapers and steamer mail, together with an enormous quantity of first-class matter to Western points, amounting in all to 50 or 60 tons, comprising from 1500 to 1800 mail pouches. The mail for this train is unloaded from the wagons, much of it re-sorted and segregated for the different cars and dispatched from the station in less than three hours. Over 25 tons is handled during the last hour, the bags being frequently unloaded into the cars at a rate as high as sixty a minute. From the entrances in the spiral chutes the bags descend through the winding convolutions of the chutes continuing their journey along the rapidly moving belts, and finally emerge at the door of the car, almost noiselessly, the entire journey occupying about thirty seconds.

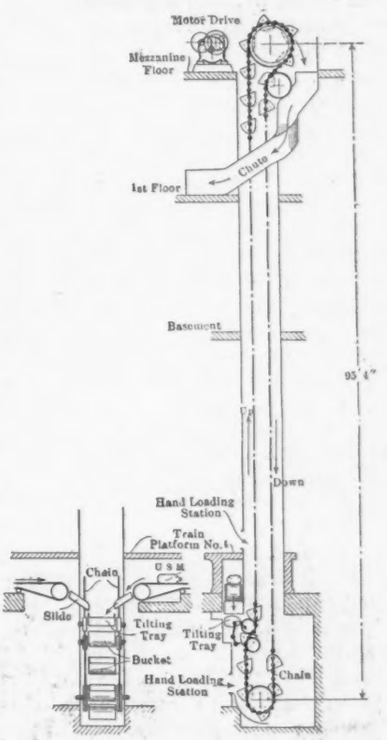


FIG. 14—FRONT AND SIDE ELEVATION OF BELT CONVEYOR AND BUCKET LIFT FOR HANDLING INCOMING MAIL

The average daily weight of mail loaded on the regular outgoing postal trains of the Pennsylvania Railroad and the duration of the loading periods are shown on the accompanying chart, each train being designated by its regular number. By reference to the chart showing the total weight of mail loaded and time of loading it will be seen that about 50 tons of mail are loaded on train No. 11 and during this period over sixteen tons are loaded on train No. 53. Simultaneous loading of mail aggregating over 60 tons also occurs on trains Nos. 19, 55 and 1019.

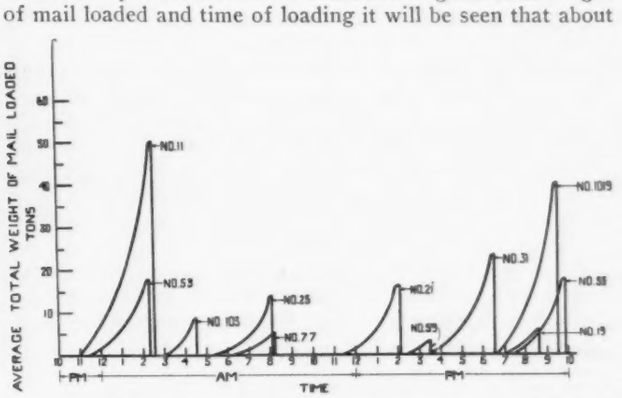


FIG. 15—CHART OF LOAD OF MAIL-HANDLING MACHINERY

In a later issue will be given a description of the wiring, illumination and other features of the installation.

Utilizing Electrical Energy in the Construction of Subway at Boston

The Boston Transit Commission is busily engaged at present in building a new double-track subway which will extend from the Charlesgate district in the Back Bay to the Park Street station of the Boston Elevated Railway Company's system, a distance of about 2 miles. When completed, the subway will establish an unobstructed entrance into the heart of the city for surface cars operating between Allston, Brookline, Brighton, Watertown and Newton and the business center. Stations are to be built near Massachusetts Avenue and at Dartmouth Street, and it is probable that the running time between the suburbs and Boston proper will in consequence be reduced by seven or eight minutes with the completion of the subway. In order that the present rolling stock may be used the subway is to be equipped for overhead trolley service. The Hugh Nawn Contracting Company of Boston is building the first three sections, which extend substantially from the intersection of Commonwealth Avenue and Beacon Street to the Boston Public Library, near Copley Square. Advantage being taken of the contractor's previous experience with electrical energy in the construction of the Cambridge subway (*Electrical World*, July 28, 1910, page 199), electric lighting and motor service is employed almost exclusively in the building of this very important addition to the Boston underground line.

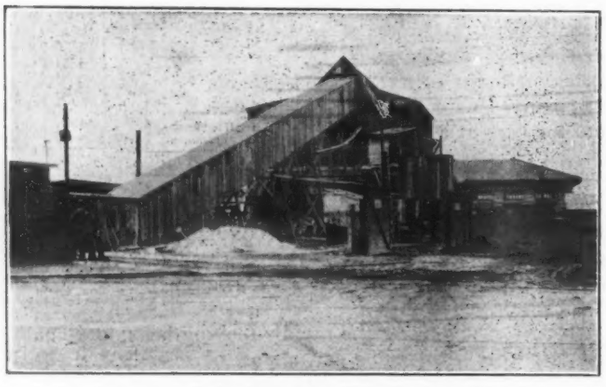


FIG. 1—CONCRETE MIXING PLANT

Electrical energy is supplied by the Edison Electric Illuminating Company of Boston and by the Boston Elevated Railway to seventeen motors having a combined rating of 723 hp and to 2500 100-watt incandescent lamps which are in use in the work. The motors range from 1 hp to 200 hp in individual ratings and are in service on the three sections above referred to, which occupy a total length of about a mile. The average rating per motor is 42.5 hp. The applications include the operation of hoists, pumps, cableways, air compressors, woodworking and metal-cutting machinery and the driving of a large concrete-mixing plant. Reinforced concrete is extensively employed in the construction of the subway, and as the latter traverses residential and business districts of the highest class, the substitution of electric and pneumatic equipment for the ordinary steam-driven type machines has done much to minimize the noise, dirt, smoke and confusion usually associated with such extensive undertakings. With one or two minor exceptions, all machinery used on the work is either primarily or secondarily driven by electrical energy. The subway is being built by the "open-cut method," and a large part of the traffic ordinarily occupying Boylston Street west of Copley Square is being temporarily diverted to other thoroughfares. A large amount of excavated material is raised to the surface by electric cranes covering hatchways in the sidewalk or roadway, and as the forces of the contractor frequently work twenty-four hours a day, the load has excellent characteristics from the central-station viewpoint.

Contractor's Plant

All of the machines in use, with the exception of portable electric hoists and pumping equipment of moderate size, are located in the Charlesgate district. The field headquarters of the contractor are located at the so-called Beacon

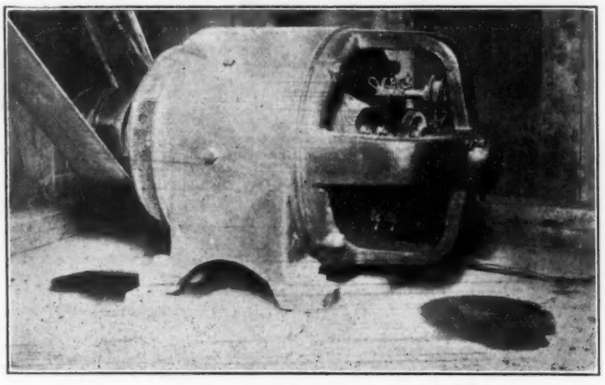


FIG. 2—MOTOR OPERATING CONCRETE MIXER PLANT

Street yard, at the intersection of Beacon Street and Charlesgate East. At this point are situated a large concrete-mixing installation, a rod-cutting shop, blacksmith shop and bolt-cutting shed, and a woodworking plant. The mixing plant, shown in Fig. 1, has been arranged so that it may handle the material as economically as possible. It contains a belt conveyor gallery leading to overhead bins the storage capacity of which is 416 tons of crushed rock, 60 tons of sand and 90 tons of stone dust. The bins are located near the top of the frame structure shown in the background and discharge their contents into measuring hoppers connecting with a 1-cu. yd. concrete mixer. The outlet from this mixer is about 8 ft. above the ground, and from it wagons can be loaded easily. Stone, dust and sand received on the premises are dumped from wagons or motor trucks into a hopper installed at the ground level, over the belt conveyor. The belt ascends a 17.5-deg. incline, at 350 ft. per minute. Its width is 18 in. and its capacity is 60 cu. ft. of stone a minute. The installation also contains a vertical cement-bag conveyor running from the ground to a storage compartment in the building, from

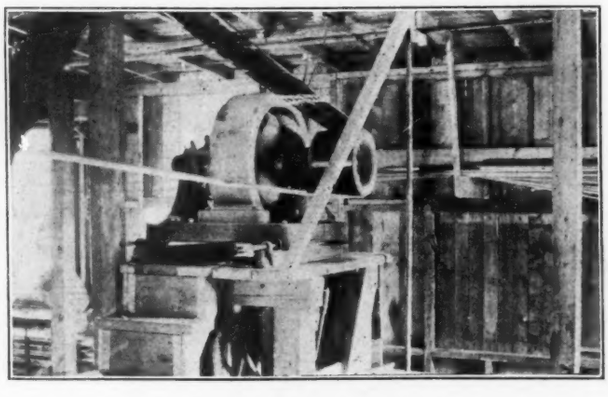


FIG. 3—MOTOR DRIVING CARPENTER SHOP

which quick deliveries can be made to the mixer. About ten bags a minute can be handled, and the storage capacity is about 1800 bags. The two conveyors and the mixer are all group-driven by a 35-hp, 550-volt direct-current General Electric motor running at 1200 r.p.m. The motor is located, as shown in Fig. 2, in a separate compartment and is mounted on a concrete foundation. It is belted to a main

shaft equipped with pulley and clutch connections by which any portion of the plant can be shut down without interfering with the remainder. The motor switch, starting box and fuses are located near the motor.

Auxiliary Shops

The carpenter shop contains a 12-in. joiner, a 24-in. planer, an 18-in. circular saw, band saw and grindstone,

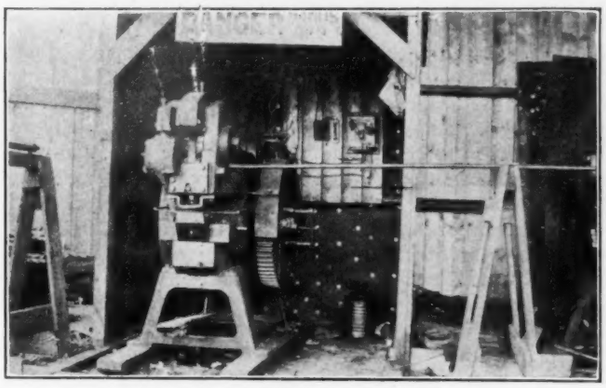


FIG. 4—MOTOR-DRIVEN SHEAR AND PUNCH

which are group-driven from a main shaft and countershafts operated by a 40-hp, 550-volt Holtzer-Cabot direct-current motor running at 900 r.p.m. The motor is mounted on a platform 5 ft. above the floor, as shown in Fig. 3, and is equipped with a 14-in. pulley, from which a 7.5-in. belt drives a 42-in. main pulley in the center of the main shaft. Short stairs are provided to facilitate access to the motor from the floor. The starting box is mounted at the rear of the platform.

The bolt-cutting equipment consists of a No. 12 Greenfield bolt cutter housed in a small shed near the carpenter shop and driven by a 5-hp, 550-volt Westinghouse series motor. A short 4-in. belt is used, enabling the motor to be located in a corner out of the way of the operator. The blacksmith shop is provided with a forge blower driven through a 2-in. belt from a 1-hp, 550-volt General Electric motor running at 1500 r.p.m. The motor is located in a cabinet with a removable cover giving access to the commutator and brushes. Fig. 4 illustrates one of the rod-cutting machines which is installed in the open with a light covering overhead. Each machine consists of a combina-

FIG. 5—ELECTRIC CRANE

tion shear and punch capable of dealing with a maximum of 2-in. stock and is gear-driven by a 5-hp, 550-volt General Electric motor operating at 1800 r.p.m. The two machines and the hand-bending equipment in use have handled over 32 tons of stock in eight hours. The motors are each provided with a starting rheostat having a no-voltage release. The lighting of the Beacon Street yard is provided by a number of 100-watt incandescent lamps connected in series circuits of five each and supplied with energy from the same lines as the motors. Connection is made with one of the railway company's overhead feeders at the yard entrance, and a cut-out box containing a watt-hour meter fuse and main switch is placed between the feeder and the yard service. The ground return is connected from each motor to the regular negative conductors of the railway system.

Compressor Plant

The air-compressor plant, which is housed in small temporary buildings, is located at the intersection of Commonwealth Avenue and Charlesgate West, near the Hotels Somerset and Canterbury, in a neighborhood where a steam-driven installation would be highly objectionable. Two Ingersoll-Rand 22-in. by 13-in. by 16-in. compound compressors are installed in these buildings, in order that they may be out of wind and weather, and each supplies air at a pressure of about 100 lb. per square inch through a 6-in. delivery pipe to a tank 4.5 ft. in diameter and 12 ft. long, located immediately outside the building. Each tank is arranged to feed into a 4-in. main leading to the extreme eastern end of the work, about a mile distant. A main also leads from the tanks to the outlet of the subway about 500 ft. from the plant. The compressed air is used in the operation of hoisting engines, pumps, a Caniff grouting machine and portable tools located at various points in the field.

FIG. 6—ELECTRICALLY OPERATED CABLEWAY

Each compressor has a capacity of 1300 cu. ft. per minute at normal pressure and is belt-driven by a 200-hp, 550-volt, three-phase, 60-cycle General Electric induction motor of the internal rheostat type. The motors are installed on concrete foundations and operate at 600 r.p.m. The motor switches are of the oil type, mounted on the wall near each unit, and provision is made by means of a double-throw switch to supply energy to the motor from the regular Edison 440-volt service in case of failure of the other supply line. Normally energy is taken for this plant from the Boston Edison company's 13,200-volt, three-phase underground lines traversing the outer Back Bay. The transformer house, built for the contractor, contains two 20-kw oil-cooled transformers which reduce the potential from 13,200 volts to 2300 volts, and in a separate compartment, partitioned from the first by an asbestos-lined barrier, are 100-kva transformers of the oil-cooled type, which further reduce the potential to 550 volts for motor service. Watt-hour meters installed here register the entire motor load. A brick wing at one side of the temporary substation contains the cable terminal and high-tension oil-switch equipment, connection being made to the service mains through an adjacent manhole by a short temporary underground line. Two large ventilators are provided on the roof of the transformer house to facilitate the dissipation of heat, and a similar installation is in service on the roof

of the compressor room, with risers at the end of the building directly connected to the compressor intakes.

Electrically Driven Cableway

Near the compressor plant is installed a cableway 370 ft. long, which spans a small stream under the bed of which the subway passes. The cableway is used in hoisting and

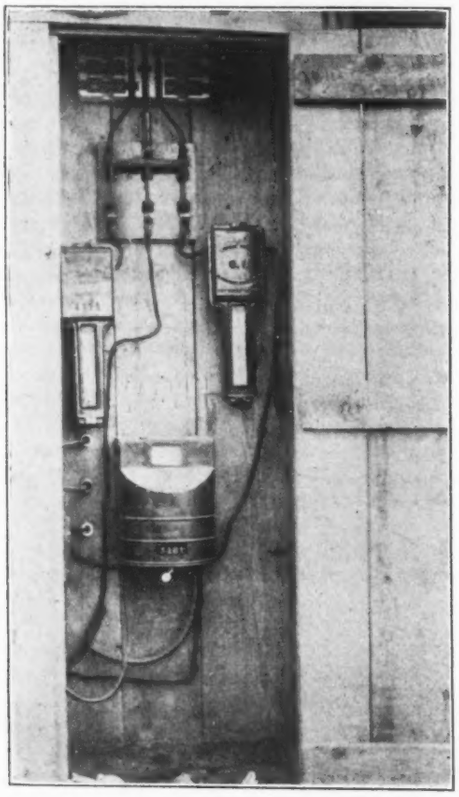


FIG. 7—TYPICAL DISTRIBUTION BOX FOR LIGHTING

lowering material, handling waste, etc., in a small basin between Charlesgate East and Charlesgate West which is difficult to reach with teams. The towers are about 40 ft. high, and on the cableway a traveling bucket of 1-cu. yd. capacity is operated by a 37-hp, 440-volt induction motor. The motor is geared to a hoisting drum and the equipment has handled a maximum load of about 5 tons, consisting of a boiler and engine for pile-driver service. Fig. 6 shows the motor housing and a portion of the adjoining tower.

Electrical energy is used in a permanent pump well near the bottom of the subway invert at Charlesgate East for the operation of pumps handling the drainage on each side of this point. The equipment, which is mounted in a concrete chamber above the well, consists of a 6-in. horizontal centrifugal pump directly connected to a 30-hp, 550-volt direct-current Westinghouse motor; a 4-in. centrifugal pump directly driven by a 15-hp, 550-volt direct-current General Electric motor, and a Warren steam pump operated by compressed air. The two motor-driven pumps are controlled by float switches attached to Cutler-Hammer starters. When the subway is completed the water from the well will be discharged into Muddy River and thence into the Charles River Basin. A 6-in. Lawrence centrifugal pump driven by a 40-hp, 550-volt direct-current Holtzer-Cabot motor is also installed in a pump house on the street near the permanent chamber to handle ground water, part of which is directed to a well to prevent it reaching the subway. Energy for the operation of the foregoing pump motors is normally supplied by the Boston Elevated Railway Company through a No. 4-0 tap containing a switch and watt-hour meter installed on the surface near the pump well. An emergency connection is also made with the railway company's feeder lines near the Beacon Street yard, to be used in case of trouble on the railway system in the district supplying energy to the former feeder circuit.

Operation of Hoists

Near the site of the Massachusetts Avenue station of the subway two electrical hoists, one located on the surface of the highway and the other in a depressed area adjacent to the Boylston Street bridge over the Boston & Albany Railroad, are in operation. At the former location mentioned is a road derrick with an 18-ft. boom and is operated by a 22-hp, 440-volt, 60-cycle, three-phase motor. The latter is provided with a revolving boom 30 ft. in length and is operated by a 22-hp, 440-volt motor of the induction type. A bull wheel in the equipment is operated by 5-hp, 440-volt induction motor. A portable stiff-leg derrick is in use near Hereford Street and is operated by a 20-hp, 550-volt motor. Among the other equipment in this neighborhood are a radial jib hoist of 10-ton lifting capacity operated by a 20-hp, 550-volt direct-current motor on the hoisting drum, a 5-hp motor of the same type being used in turning the derrick on a vertical axis, and also a centrifugal pump, direct-driven by a 15-hp, 550-volt direct-current motor.

Energy is supplied for the operation of the induction motors and the cable hoist motors mentioned above from the Edison underground service. In some cases armored cables are used to convey energy from the nearest distributing center to the under side of the hoist; in other instances the feed is taken from a temporary overhead line carried along the side of the work. On the radial jib hoist the king-pin is equipped with insulated-contact rings and carbon brushes to facilitate the supply of energy while the machine is rotated. Fig. 8 illustrates the method used in carrying the three-phase, 440-volt motor circuit under the sidewalk at a point in the Charlesgate district where sheet steel piling driven below the surface made extra precautions necessary in handling the wires. The circuit is carried in a 3-in. suction hose, and the entrance of the leads is fitted with a temporary covering of tar paper to prevent the entrance

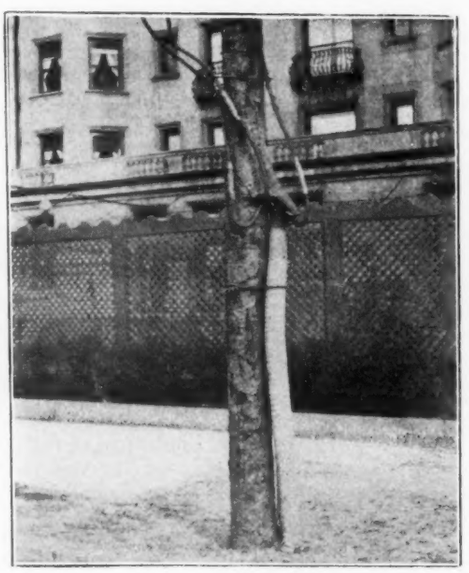


FIG. 8—POWER CIRCUIT AT TEMPORARY SIDEWALK CROSSING

of water. This 440-volt service is carried across the Muddy River basin by overhead lines of No. 4-0 cross-section.

Lighting

Emergency lighting is provided for on Boylston Street by a No. 6 feeder off which taps are taken at intervals to groups of five lamps. Energy thus used is metered by the

railway company at the point where the feeder joins the regular distribution system. The remainder of the lighting energy in the field is supplied from the Edison three-wire, 110/220-volt direct-current underground circuits, through switch boxes typified in Fig. 7 and containing the usual demand indicators, watt-hour meter switch and fuse equipment. Electric car-heating equipment is used in warming the interior of a temporary oil house. The energy consumption for the entire outfit of the contractor averages about 135,000 kw-hr. per month at present.

Experiments with Umbrella Antenna

By JOSEPH O. MAUBORGNE

Recent experiments made at Fort Leavenworth, Kan., by Field Company D, United States Signal Corps, under the direction of Captain George S. Gibbs, Signal Corps, and with the assistance of the writer, with a view to determining the relative received strength of wireless signals, corresponding to various methods of setting up the umbrella antenna and counterpoise, resulted in the measurements given below.

The "regular antenna" and counterpoise system of the Signal Corps pack sets mentioned in this article consists of a four-wire antenna of the umbrella type, supported by a pole 40 ft. high, ribs of umbrella usually set up 90 deg. apart, each wire 85 ft. long, and connected by three insulators in series with a guy rope 150 ft. long, which is tied to a pin in the ground, thus guying the pole. When set up in this position the lowest ends of the antenna are about 18 ft. above the ground. The counterpoise consists of four wires of a special stranded cable, each wire 100 ft. long, rubber-insulated, laid upon the ground, outer ends insulated from ground and inner ends all joined electrically and connected to the sending apparatus by a short lead of the same insulated cable. Normally this counterpoise is spread out so that each wire of the counterpoise is directly under one of the antenna wires. It will be observed that this is not really a counterpoise but a capacity ground.

For the purpose of the measurements recorded herein (except in the last case, when only a hand generator was used) both storage batteries and small hand generators were alternately used as the source of energy for the sending set, which was the regular 1909 model Signal Corps pack radio set. This sending station was set up about 5 miles from the radio station of the Army Signal School, where there was installed in series with the telephone receivers of an inductive receiving set a fairly sensitive reflecting galvanometer, the deflections of which were considered to be proportional to the sound in the telephone receivers, since both strength of received signals and deflection of galvanometer are proportional to the square of the current through the telephone receiver and galvanometer respectively. No arrangement was made actually to measure the strength of the received current in these tests. With the sending station emitting constantly and regularly the American Morse signals "VL," the receiving observer took the average deflection over sending periods of three minutes for each test, deflections of the galvanometer being read at the end of each "L" made by the sending station. A Pyron detector was used at the receiving station, and its adjustment and the adjustment of the receiving apparatus to resonance were not varied during the tests on any particular day. Tests were made on two different days, and hence with two different adjustments of the detector, which accounts for the difference in strength of received signals obtained on different days.

Three different experiments were made in the following manner:

First: To determine the relative sending efficiency of the umbrella antenna and counterpoise system as a radiator, when used normally as described above, and again, everything else remaining the same, when the counterpoise was rotated so that its horizontal projection made an angle of 45 deg. with the horizontal projection of the aerial wires.

Second: To determine the relative sending efficiency of an eight-wire antenna of the same natural period as the four-wire antenna.

Third: To determine the relative sending efficiency of a regular antenna and counterpoise system set up in the normal way, as compared with the same aerial when the antenna wires are guyed further out so as to result in a "flat-top" umbrella.

Fourth: The relative efficiency when the ends of the antenna wires of the normal set are lowered to within 3 ft. of the ground.

Case 1. Normal set-up. Four-wire antenna, outer ends of antenna wires 18 ft. above ground and counterpoise coinciding with horizontal projection of antenna wires. The average strength of signal (galvanometer deflection) was 11.62.

Case 2. Normal set-up except that each counterpoise wire was moved from its position directly under an antenna wire to a position half way between two adjacent aerial wires. The average strength of signal was then 13.2, or a gain of 14.45 per cent over Case 1. On July 9 another test was made, and an average reading of 7 was obtained for the normal set-up, against 8.43 as the average reading for the arrangement with counterpoise wires removed 45 deg. from the horizontal projection of the antenna wires. This was a gain of 20.4 per cent, or an average of 17.43 per cent, as the result of the two experiments.

Case 3. Eight-wire antenna on 40-ft. pole, wires each 65 ft. long. This gave the antenna system the same natural period as that of the four-wire antenna normally used. Length of supporting antenna, 170 ft.; height of lowest ends of antenna, 29 ft. A normal counterpoise was employed in the usual arrangement. The average strength of received signals was 13.32, or an increase over the four-wire antenna of Case 1 amounting to 14.63 per cent.

Case 4. Regular four-wire antenna and counterpoise, with normal set-up; height of outer ends of antenna, 18 ft. In this case the average deflection of galvanometer or strength of signal was 26. The outer ends of the antenna were then raised from 18 ft. to 40 ft. above the earth, making a four-wire umbrella "flat-top" aerial. Then the average reading was 39.3, or a gain of 39.6 per cent in the strength of received signals. The change in wave length was so slight that no change was made in the adjustments of the receiving apparatus.

Case 5. (Experiments made on second day.) The regular antenna and counterpoise using a normal set-up first gave 7.45 as average strength of signal. The outer ends of the antenna were then lowered from 18 ft. to within 3 ft. of the ground. After this change the average reading or strength of signal was 6.8, making a loss of only 6 per cent caused by the lowering of the outer ends of the antenna.

While the experiments were few and the data so meager as to make it impossible to obtain satisfactorily the operating characteristics for the sending side of this form of antenna, they show conclusively the advantages of the "flat-top" antenna over the umbrella type for sending as well as for receiving, which was pointed out in a paper on the operating characteristics of umbrella antenna,* published in the *Electrical World* a little more than a year ago. The increase of strength of signal due to moving the counterpoise from its regular position is still a matter for thought, and no satisfactory explanation of it has yet been found. One also has to ponder over the small loss of energy due to dropping the ends of the antenna wires from 18 ft. to 3 ft. above the ground. Theoretically, if Dr. L. W. Austin's work is considered, the diminution should have been considerably greater.

*"Wireless Telegraph Antennæ. Operating Characteristics of the Umbrella Type of Aerial," by Mr. David Darrin.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Minneapolis General Electric Company's Aid to Santa Claus

For the holiday season the Minneapolis General Electric Company offered to loan without charge to any church or benevolent institution planning a Christmas festival between Dec. 15 and Jan. 5 a complete electric Christmas-tree lighting outfit. No restriction was made as to the size of the outfit to be furnished in carrying out this generous offer, but it was necessary, of course, that the building in which the celebration was held should be supplied with electric service by the company.

"Ky-El-Co" Domestic Advertising

The Kentucky Electric Company of Louisville plans to have an electric incubator hatching broods of succulent "springers" with startling regularity as the January feature of its window display. Its commercial department is also distributing among tens of thousands of local householders a useful advertising novelty in the shape of a paring knife for the kitchen, suitably stenciled with an advertising legend. The purpose of the knife is, of course, to keep the advantages of "Ky-El-Co" light and heat for culinary purposes constantly before prospective and present consumers.

City Taxes Water-Power Washers

Since Sept. 1 the city of St. Louis has taxed every water-power washing machine in local use at the rate of $3 per year. Experiments recently conducted by the engineers of the water department showed that the actual cost of supplying water to such a washer three hours per week is about $2.95 per year for the requirements of the average small family. As the result of the new yearly tax of $3 on the hydrant-operated machines, electrically driven washers have been mounting in popularity more rapidly than ever. The motor-driven washers, of course, are free from the annoying drippings of the water-power devices and can be used any place where there is an electric-lamp socket.

Reporting Election Results Over Central-Station System

Communities supplied with central-station service by the great system of the Southern California Edison Company, "from the desert to the sea," were informed of the results of the balloting on the night of the recent presidential election by prearranged "blink" signals which affected every lamp on the system.

According to the schedule which had been printed in advance in the local newspapers of the eighty-four cities and towns reached by the signals, two "blinks," each consisting of five seconds of darkness, meant "Wilson elected." Three blinks would have indicated a Roosevelt success, and four that Taft had been elected. The scheme was carried through with entire success, the two five-second interruptions being sent out as soon as the results of the election were conclusively known. Customers of the company's service in all the eighty-four communities were in this way able to get the final returns at the earliest possible moment without leaving their own homes. Los Angeles, Santa Monica, Redlands, Pasadena, Beverly, Long Beach, Riverside, Venice and San Bernardino were among the principal places furnished with election results over the central-station lines.

Filing Information on Houses Wired

For filing away data collected by its solicitors and appliance representatives concerning the wired and unwired houses in its territory a Southern central-station company has adopted the plan of having each building, wired or unwired, listed on a separate card. When the building is wired the left-hand corner of the card is clipped, and when connected the right-hand corner is clipped. These cards are filed in drawers by streets. The extending corners indicate the unwired and unconnected buildings, and these, of course, are the ones on which the sales force concentrates. The cards give valuable information covering points of interest to the central station. Index numbers across the top of the card are used in connection with metal markers to indicate appliance "prospects." For instance, if the marker is on the first space, it indicates a prospect for a flatiron; if on No. 15, a prospect for a washing machine, etc.

Starting Things Moving in a Town of 4500

Central-station service in a Southwestern town of 4500 was formerly furnished by a local company which had no downtown office or commercial department, but transacted such business as it had at its plant, located nearly a mile from the center of the little city. The service was equally primitive in other respects. There was no day circuit, except on Tuesdays and Thursdays, and little effort was made to connect up new business.

Recently the property was purchased by a syndicate whose new local manager immediately realized the undeveloped opportunities in the little community and at once opened a downtown sales office near the business center. The new headquarters is an attractive place by day and brightly lighted by night. "Taking its own medicine," the company has installed a complete line of lighting equipment, appliances and motor-driven apparatus and invites the townspeople to make the office their headquarters.

Day service has been inaugurated, and motor "prospects" are being aggressively canvassed. Among the long-hour day loads in sight is the municipal water pumping, which will require a 20-hp motor-driven pump. Arrangements are also under way to install forty-eight five-lamp ornamental tungsten standards around the public square.

When the new office was formally opened personal invitations were sent out to everyone in the town. In one window a toast-eating contest was held; the other window contained an electric washing-machine exhibit. Food cooked by electricity in fireless stoves, chafing dishes, etc., was served to the guests, who also received souvenirs in the form of electric iron holders, ice picks, etc. During the evening a special moving-picture show was held at the local opera house. Besides two regular films, there was an exhibition

of two reels on electrical subjects, depicting the education of a householder in the use of modern domestic appliances. These films were loaned by one of the large electrical manufacturers. Every guest of the company who attended the office opening received a ticket for the moving-picture exhibition.

Electric Truck with Trailer for Newspaper Delivery

The Detroit *News* publishing company is planning to employ a 1000-lb. trailer wagon in connection with its electric trucks for making city deliveries. The trailer will be used for hauling the papers for two of the distributing stations, being dropped off at the second station while the battery-driven car goes on about its rounds. Returning, the trailer will be picked up at the last station and brought back.

Five 3000-lb. cars, four 2000-lb. cars and one 1000-lb. electric delivery car are already in use by the Detroit *News*, as stated in a recent item in these columns. The company purchased its first electric car three years ago and has since operated its delivery service each day of every month. An average for the 1-ton car which is typical of the service is 1577 miles a month, the daily average being 51 miles. Energy costs about $10 a month. An exact record is kept of the cars and an experienced man cares for them in the garage adjoining the printing plant. Energy and distilled water, as compared with oil and gasoline for a similar gasoline vehicle, cost less than one-half, based on the actual figures per mile. The *News* cars are among the busiest in Detroit and average 40 miles or more daily.

Rate Schedules from the Customer's Standpoint

The advantages and disadvantages of various types of central-station rate schedules, from the standpoint of the solicitor approaching a prospective customer, were discussed by Mr. J. E. Bullard in our issue of Nov. 16, in an article entitled "Rate Systems from the Central-Station Solicitor's Viewpoint." Mr. Bullard brought out some of the prominent disadvantages of the older forms of schedule and dwelt in particular upon the importance of approaching prospective consumers with tact and of taking care not to prejudice them by mishandling the presentation of a schedule. The consideration of rate systems and data from the point of view of a customer or layman is something to which every central-station manager and solicitor should give careful thought, because the presentation of information about rates in simple language and intelligible form frequently does much to gain public confidence and good will. The force of these statements is sometimes best illustrated by an example of how not to do it.

In a recent instance a central station serving a well-populated territory of considerable size had a new residence customer, who, in addition to using energy for lighting, also had an electric cooking range and a 2-hp motor. This customer was informed that the range and the motor would be served through a separate meter, under the so-called power schedule. But, desiring to keep a separate record of the cost of operating the range, he finally succeeded, after some trouble, in having separate meters installed for the range and the motor. When the first bills came in this customer was unable to check the bill for energy consumed by the motor, under the terms of his contract. Already somewhat irritated by the tactless treatment he had received from the company, he demanded an explanation. Instead of sending a solicitor to call on this consumer, the company mailed him a discount schedule, shown below, accompanied by a letter which neither explained the schedule nor answered his inquiry and only irritated him further.

This table of discounts was printed on a simple two-leaf folder bearing on the reverse sides the caption "Rate Schedule for Ideal Power" and a brief enumeration of the uses of electric motors for various purposes. It will be noted that the base rate is 10 cents per kw-hr., and it is also fairly evident that the second column gives the minimum monthly bill for different sizes of motor. But beyond these simple observations nothing is self-evident to the layman or consumer who possesses no technical knowledge. Let us suppose that our consumer received a bill as follows:

85 kw-hr. at 10 cents per kw-hr.	$8.50
Less 20 per cent discount	1.70
Net bill	$6.80

It is quite evident that the basis of computation is a 10-cent rate, and that the monthly minimum bill for a 2-hp motor would be $2, but an explanation of the discount is less simple. The question arises, Why is the discount 20 per cent, and is that particular discount the correct one under the terms of the contract? Of course, an expert would quickly see that the scheme of discounts is really equivalent to a rate which drops abruptly, step by step, from 10 cents to 9 cents, then 8.5, 8, 7.5, 7 cents, etc., to 4 cents as the lowest rate. An expert would also discover that

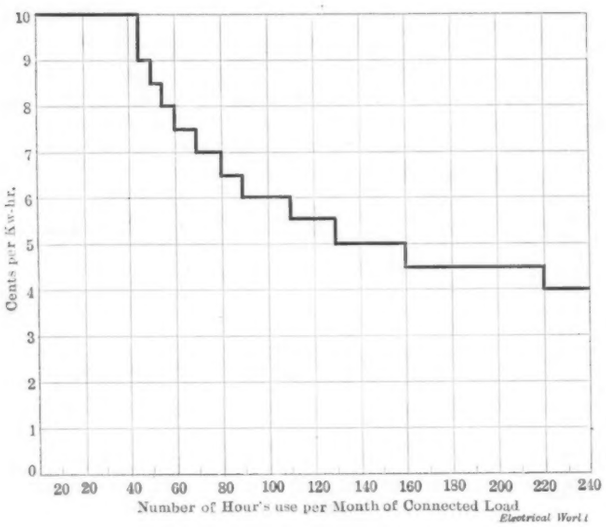
DISCOUNT SCHEDULE—BASE RATE 10 CENTS PER KW-HR.

Hp.	Monthly Minimum.	10 per Cent.	15 per Cent.	20 per Cent.	25 per Cent.	30 per Cent.	35 per Cent.	40 per Cent.	45 per Cent.	50 per Cent.	55 per Cent.	60 per Cent.
1	$1.00	$3.37	$3.75	$4.15	$4.50	$5.25	$6.00	$6.75	$8.25	$9.75	$12.00	$16.50
2	2.00	6.74	7.50	8.30	9.00	10.50	12.00	13.50	16.50	19.50	24.00	33.00
3	3.00	10.11	11.25	12.45	13.50	15.75	18.00	20.25	24.75	29.25	36.00	49.50
4	4.00	13.48	15.00	16.60	18.00	21.00	24.00	27.00	33.00	39.00	48.00	66.00
5	5.00	16.85	18.75	20.75	22.50	26.25	30.00	33.75	41.25	48.75	60.00	82.50
6	6.00	20.22	22.50	24.90	27.00	31.50	36.00	40.50	49.50	58.50	72.00	99.00
7	7.00	23.59	26.25	29.05	31.50	36.75	42.00	47.25	57.75	68.25	84.00	115.50
8	8.00	26.96	30.00	33.20	36.00	42.00	48.00	54.00	66.00	78.00	96.00	132.00
9	9.00	30.33	33.75	37.35	40.50	47.25	54.00	60.75	74.25	87.75	108.00	148.50
10	10.00	33.70	37.50	41.50	45.00	52.50	60.00	67.50	82.50	97.50	120.00	165.00
11	11.00	37.07	41.25	45.65	49.50	57.75	66.00	74.25	90.75	107.25	132.00	181.50
12	12.00	40.44	45.00	49.80	54.00	63.00	72.00	81.00	99.00	117.00	144.00	198.00
13	13.00	43.81	48.75	53.95	58.50	68.25	78.00	87.75	107.25	126.75	156.00	214.50
14	14.00	47.18	52.50	58.10	63.00	73.50	84.00	94.50	115.50	136.50	168.00	231.00
15	15.00	50.55	56.25	62.25	67.50	78.75	90.00	101.25	123.75	146.25	180.00	247.50
16	16.00	53.92	60.00	66.40	72.00	84.00	96.00	108.00	132.00	156.00	192.00	264.00
17	17.00	57.29	63.75	70.55	76.50	89.25	102.00	114.75	140.25	165.75	204.00	280.50
18	18.00	60.66	67.50	74.70	81.00	94.50	108.00	121.50	148.50	175.50	216.00	297.00
19	19.00	64.03	71.25	78.85	85.50	99.75	114.00	128.25	156.75	185.25	228.00	313.50
20	20.00	67.40	75.00	83.00	90.00	105.00	120.00	135.00	165.00	195.00	240.00	330.00
		1.73	1.92	2.13	2.31	2.69	3.08	3.46	4.23	5.00	6.15	8.46

Note.—The figures on the line above indicate average hours run per day under *full load* (twenty-six days per month).

the figures in the row at the bottom of the table giving average hours of use per day, presented in awkward and unusual decimal values, are respectively equivalent, within a few cents' final difference, to 45, 50, 55, 60, 70, 80, 90, 110, 130, 160 and 220 hours per month (obtained by multiplying the average hours per day, given in the table, by 26, the number of active days assumed in a month). This net rate could then be represented by the curve shown herewith. This form of rate, incidentally, is open to the objections discussed by Mr. Bullard in connection with Figs. 1 and 2 of his article before mentioned.

Returning to the case of the consumer with a bill for $6.80 for one month's energy, it is perfectly obvious that he could not translate kilowatt-hours to horse-power-hours, or vice versa, without knowing that 1 hp is equivalent to 746 watts or 0.746 kw. But there is still another factor present, because a motor yielding an output of 2 hp at the pulley would consume more than 2 electrical hp. If the commercial efficiency is 80 per cent at full load, the half-load efficiency will be somewhat less, and at quarter load still lower. Assuming 100 per cent efficiency and 55 hours' full-load use per month of a 2-hp motor, the total energy used would be 82 kw-hr. and the gross bill would be $8.20. Looking in the table, we find a figure of $8.30, which is



NET RATE FOR MOTOR SERVICE

evidently the gross bill for such a motor used 2.13 hours per day (55 hours per twenty-six-day month). This indicates that the figures in the table stand for the gross monthly bill, taking the motor efficiency as 100 per cent and the horse-power equivalent as about 750 watts. If a 15-hp motor, for example, is used at full load 80 hours per month, the gross bill will be $90, taking the horse-power equivalent as 750 watts; this checks the tabular bill for such a motor used 3.08 hours per day, or 80 hours per twenty-six-day month. It requires no argument to convince one that the average consumer could never check or understand the table without further explanation. Furthermore, the table is in error in every instance by the amount involved in disregarding the actual commercial efficiency of the motor.

According to the erroneous assumptions made in computing the table, the consumer's bill for 85 kw-hr. represents a 2-hp motor operated at full load for 56.7 hours during the month. Assuming, as a matter of fact, that the full-load efficiency is 80 per cent, the motor could have operated only 45.3 hours. Therefore the tabular values of the gross bill are all too low. The 20 per cent discount in the example we have used is explained after some study of the table. When the gross bill for supplying a 2-hp motor reaches $8.30 the discount increases from 15 per cent to 20 per cent, the last figure applying until the total bill reaches $9, when it increases again to 25 per cent.

It would be preferable to state this rate schedule as follows: Minimum bill, $1 per month per horse-power of rated motor capacity; monthly charge based on average use of connected load, each horse-power of rated motor capacity being taken as equal to 0.75 kw; unit rates given in the accompanying table.

UNIT CENTRAL-STATION RATE SCHEDULE

Use per Month of Connected Load.	Rate per Kw-Hr., Cents.
Under 45 hours	10.0
Over 45 hours and under 50 hours	9.0
Over 50 hours and under 55 hours	8.5
Over 55 hours and under 60 hours	8.0
Over 60 hours and under 70 hours	7.5
Over 70 hours and under 80 hours	7.0
Over 80 hours and under 90 hours	6.5
Over 90 hours and under 110 hours	6.0
Over 110 hours and under 130 hours	5.5
Over 130 hours and under 160 hours	5.0
Over 160 hours and under 220 hours	4.5
Over 220 hours	4.0

Stated even in the simplest and most direct manner, this schedule is not likely to be well understood, and it is the wisest policy to have it explained to new customers by personal interview in each case. The table given in the first instance is suitable only for the information of solicitors and should not be distributed in its present form to consumers. It is also very desirable to depart from any plan of expressing the monthly bill in terms of horse-power rating and hours of use, because the central-station service ends at the meter and consists of delivering electrical energy at that point, but not of delivering mechanical power at the motor pulley. The motor is the property of the consumer and responsibility for its operation, attendance and upkeep is his also. The simplest method of expressing a rate schedule is the best one, and none but the carefully prepared, least technical statements of rates should be placed in the hands of consumers or the public at large, with simple concrete illustrations of their application.

Purchased Electrical Energy for All Nebraska State Institutions

According to a recent special dispatch from Lincoln, Neb., to the St. Louis *Post-Dispatch*, Nebraska has found state ownership of isolated electric plants undesirable, and the Board of Public Lands & Buildings has decided to contract with private electric-service companies to furnish energy to state institutions. The old isolated plants on the state properties will be closed and probably sold. The Secretary of State is reported to have said that the state-owned plants are operated at a loss and that energy can be purchased from private companies for less than it costs the State to produce it.

For years it has been the fixed policy of the State of Nebraska to install public-owned light, power and water plants in all state institutions. These plants have been under the direct control of the Board of Public Lands and Buildings. After years of trial, however, the present board has decided to go out of the business of making electricity and it is said that some contracts have been made already with central-station companies. Mr. Wait, Secretary of State, is reported to have said that the State will save considerable money by the change. In the past the state board has paid the higher cost of production in its own plants and the taxpayers have made up the difference. But it has been decided to execute two-year contracts with private companies at the lower rates which are available.

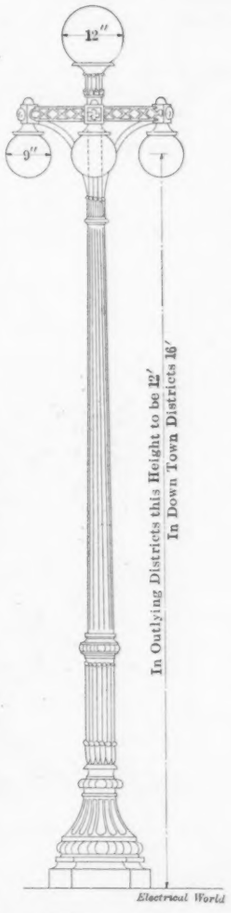
Wiring and Illumination

Standard Street-Lighting Fixtures for Chicago

Amended to comply more closely with the practical experience of the electric-service company, the ordinance providing for standard posts for electric street lighting in Chicago was introduced into the City Council of that city on Dec. 16, with fair prospect of becoming a law. For the purposes of the ordinance, street posts for electric lighting are divided into three classes—those used for commercial incandescent lighting, for downtown-district arc lighting and for outlying-district arc lighting respectively. The city electrician designates the "downtown" and "outlying" districts for arc lighting. The limits of these districts may be changed by him from time to time at his discretion.

One of the designs for street-lighting posts of Chicago made obligatory by this ordinance is shown by the accompanying drawings, which shows the standard post for commercial incandescent lighting. This refers to the ornamental or curb lighting paid for by merchants and in many cases installed and maintained by the Commonwealth Edison Company. It is provided that this post shall be of cast iron. Throughout the city except within the area bounded by Kinzie Street, Canal Street, Twelfth Street and Lake Michigan (that is, the "downtown district") the height of the post shall be such that the center of the lower globe shall be 12 ft. above the curb on which it is placed, while the upper globe shall be 2 ft. above the lower globe. In the excepted or "downtown district" the height of the post shall provide for lower globes to be 16 ft. above the adjacent curb.

Each post shall be equipped with five lamps. The upper globe shall be at least 12 in. in diameter; the lower globes shall be 9 in. in diameter.



STANDARD POST FOR CHICAGO STREET LIGHTING

An important provision of the ordinance makes it not applicable immediately to posts now installed. However, it is required that within six years from the date of the passage of the ordinance all lighting posts, either gas or electric, used for private and commercial purposes which are now standing and are lower or higher than 12 ft. to the center of the lower globes shall be replaced by posts of the prescribed height and design.

The posts in the "downtown district" and the "outlying district" for general arc street lighting are nearly, but not exactly, the same as those described in the article on "New Street Lighting in Chicago" in the *Electrical World* of Oct. 12, 1912, page 772. Some slight changes have been made by the special committee which prepared the present ordinance. The "downtown" post consists essentially of a tubular steel mast, a malleable-iron bracket, a cast-iron pole top and an ornamental cast-iron base. The height of the pole shall be such that the arc of the lamp shall be approximately 25 ft. above the level of the curb adjacent to which the post is placed. The mast consists of three sections of standard steel pipe, respectively 4 in., 5 in. and 6 in. in diameter. It is to be noted that it is planned to replace all the existing city street-lighting lamp-posts in the downtown district of Chicago with the new design within a very few months. This will work a great improvement.

In case of posts for "outlying-district" arc lighting the height of the post shall be such that the arc of the lamp shall be approximately 12 ft. above the level of the curb adjacent to which it is placed. This post also is made of tubular steel mast, but in only two sections, respectively 4 in. and 5 in. in diameter. The ornamental base of the downtown post is lacking.

Provision is made for setting this type of post in concrete. In sandy soil the pole shall be buried to a depth of 5 ft., while in clay the depth may be decreased to 4.5 ft. and in rock to 2.5 ft.

It is provided that all incandescent and arc lamps used for street lighting shall be equipped with approved diffusion globes "so constructed as to subdue the light intensity."

Hereafter no person or corporation shall erect any electric lamp-posts for commercial incandescent lighting or arc lighting within the city without first obtaining a permit therefor from the commissioner of public works. This permit shall be approved by the city electrician. Further, the permit shall contain an express provision that it is issued on the condition that posts erected pursuant to it shall be removed at once whenever the commissioner of public works shall order such removal. Blank forms are provided on which applications for permits shall be made, and a fee of $2 must accompany each application. This amount must be paid before the application is issued.

One section of the ordinance provides that in places where the physical conditions or surroundings are such that a full compliance with the specifications of the ordinance are impracticable the city electrician may allow such variations as he may consider necessary. A fine of not less than $20 or more than $200 is provided for each offense in case of violation of the ordinance. Each day's maintenance contrary to the ordinance is considered a separate offense.

Bracket-Arm Magnetite-Arc Lighting at Missoula, Mont.

Higgins Avenue, the 100-ft. main street of Missoula, Mont., is now lighted for a distance of nearly a mile by

FIG 1.—BRACKET-ARM MAGNETITE-ARC LIGHTING, MISSOULA, MONT.

6.6-amp magnetite arcs of the inverted type, carried on trolley-pole bracket arms at 100-ft. intervals along each curb. The ornamental standard used is a combination lamp and trolley post, 26 ft. high, with a round decorated base

7 in. in diameter. Trolley span wires are attached between the tops of the poles, the arcs being supported by 24-in. straight bracket arms 18 ft. from the street level. A mercury-rectifier outfit at the station of the Missoula Light & Water Company supplies direct-current energy for this series installation.

The erection of the Missoula ornamental lighting was

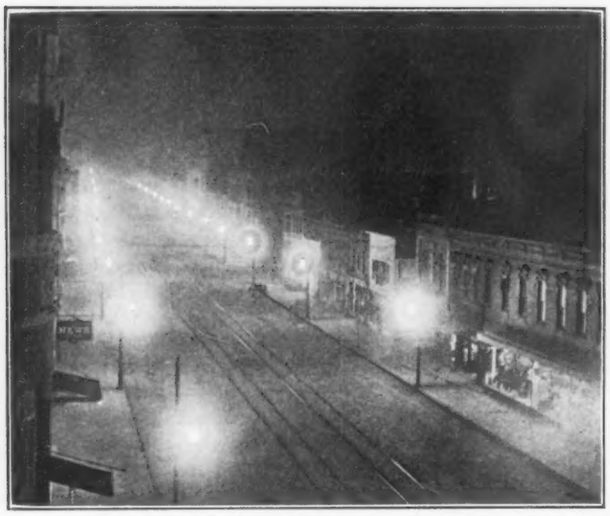


FIG. 2—NIGHT VIEW HIGGINS AVENUE, MISSOULA

facilitated, according to Mr. J. F. Derge, new-business manager for the local company, by the Montana state law which provides for the creation of special lighting-improvement districts. This law specifies that "the portion of the entire cost of erecting and maintaining posts and of the annual maintenance of lamps therein in such district, not less than one-fourth nor more than three-fourths, as shall be determined by the City Council, shall be borne by property embraced within said district abutting upon some portion of the street or avenue within such district to be lighted." To create such an improvement district requires the consent of 51 per cent of the abutting property holders, in

FIG. 3—"INVERTED" MAGNETITE LAMPS ON TROLLEY POSTS

addition to an ordinance passed by the local city government. The Missoula Light & Water Company, however, went even further in its initiative, offering to assume the entire expense of installation on the assurance of a three-year contract for the lighting. The proposition was accepted without opposition.

The standard set by the magnetite lamps is creating a demand for better lighting generally, both in and out of doors. Agitation has already begun for extensions onto other streets and into the residence sections. The lamps have also brought the city considerable publicity. The bright lights make a good impression on travelers, as is evidenced by reports of passenger conductors on trains which pass through Missoula. Higgins Avenue forms the approach to the stations of two transcontinental railroads, and the brilliantly lighted street earns the compliments of passengers both by day and by night.

The unique design of globe employed to reduce the intrinsic brilliancy of the light source gives an excellent diffusion of white light, and with the equidistant spacing of the lamps affords even illumination over the entire area lighted. Although it might seem that the shadow of the standard would be cast on the sidewalk side, this is not noticeable on account of the illumination from windows, signs and other ornamental lighting. The greatest portion of the light from the arc lamps is, of course, thrown below the horizontal plane, but there is enough above to bring into complete outline all the buildings on the street.

Notes on Underground Conduit Construction

By Guy F. Speer

It is not intended that the matter given herewith shall be looked upon as an article on present-day practice in under-

FIG. 1—MOVING GAS MAIN TO MAKE ROOM FOR CONDUIT

ground-conduit construction, but rather as a collection of notes taken during the erection of an underground-conduit system in a New Jersey city with a population of about 23,000. However, the article does reflect modern practice, especially in the laying of fiber conduit, and the methods used are typical of those employed in many cities throughout the country.

The Conduit Line

The trunk line extending through the principal thoroughfare and business section of the town consists of nine fiber ducts, laid three high, with 1 in. of concrete between ducts and a 3-in. envelope of concrete surrounding them. Extensions of four ducts, six ducts and eight ducts are made in several of the side streets to manholes. From these manholes laterals extend to poles whence taps are made to the overhead wires.

The longest section is 530 ft. and the average is 285 ft. For purely transmission purposes the sections should run longer, but for distribution purposes a manhole should be built at every intersecting street at least.

At suitable intervals in the trunk line, depending, of course, on the length of the section and the demands for service connections throughout a block, distribution holes or

hand holes should be installed. On the other side of the street from these distribution holes other distribution holes should be built, and the two should be connected by a four-duct cross-over. (See Fig. 2.) In this manner both sides of the street are served without unduly long service pipes and without having to tunnel under car tracks or other obstruction whenever a new service is cut in. This method also eliminates overcrowding of distribution holes. These holes should be spaced on an average 120 ft. apart.

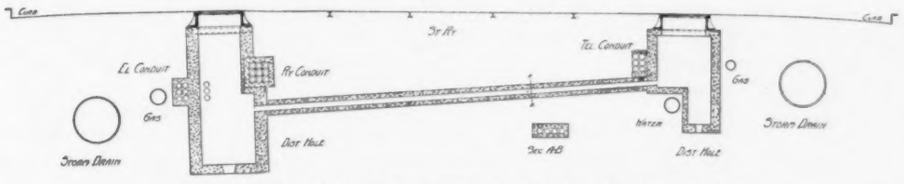


FIG. 2—TRUNK-LINE MANHOLE AND DISTRIBUTION HOLES

Before beginning excavation on the line described, test holes were dug from curb to curb, except under car tracks, at street intersections to determine upon which side of the street the main conduit line should be run, and also to discover if space were available for constructing manholes. These test holes were sunk about 7 ft. deep, and the exact location of all obstructions such as gas and water mains, sewer drains, railway and telephone conduits, etc., was carefully noted. In this case the space between the gas main and the railway conduit was not sufficient to permit the building of distribution holes and the main conduit line, and the 10-in. gas main was moved transversely from 2 ft. to 4 ft. for a distance of 1020 ft. The task, including excavating, moving the main, recalking joints, etc., occupied two weeks and cost about $500. (See Fig. 1.)

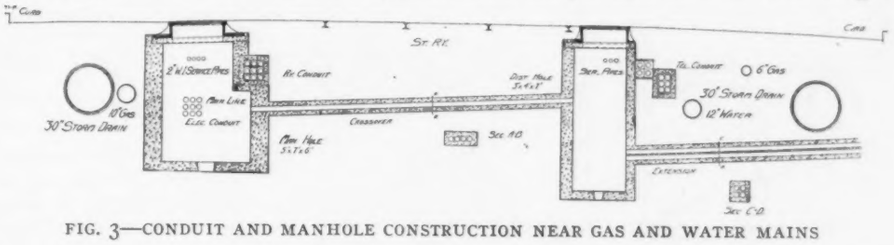


FIG. 3—CONDUIT AND MANHOLE CONSTRUCTION NEAR GAS AND WATER MAINS

The location of the conduit line being determined, a trench 22 in. wide and 43 in. deep was laid out to line and excavated. Theoretically a trench 18.5 in. wide is sufficient for a nine-duct (three-wide and three-high) line; but to permit a man to work in the trench the latter should be dug wider. The lower portion of the trench may be made narrower, however, and the depth depends on the nature of the obstructions encountered. A grade of 1 in. in 200 ft. is enough to allow for drainage into manholes. Care should be taken to avoid traps or water pockets in the conduit line.

As the soil encountered in building the line in question was hard clay, no side-bracing or sheeting was necessary. Fiber duct (3.5 in. outside diameter and 0.25 in. walls) was used throughout the work except in crossing through the roofs of culverts or large sewers, where 3-in. wrought-iron pipe was used. Fiber conduit is light in weight, cheap, easy to handle and can be laid by unskilled labor. No attempt was made to waterproof the conduit, the concrete envelope forming only a support and protection to the duct. The socket joint was found to be more satisfactory than the sleeve joint, because the latter required more time to fit and the sleeves very often slipped down over the end of the duct, leaving an opening.

After the trench was dug a 3-in. footing of concrete was put in, 1:3:6 mixture with ¾-in stone being used. On this footing the duct was laid on 4.5-in. centers, a "rake" being used for this purpose. Concrete was then rammed between the ducts and a 1-in. cover of concrete put on. This process was repeated until the top layer of duct was reached, when a 3-in. cover of concrete was put on. The trench was then refilled, tamped thoroughly and the street opening repaved. During construction care was exercised to keep the conduit as far as possible from the gas main so as to avoid danger of gas leaking into the line and manholes and causing explosions. Moreover, by this means danger of puncturing the ducts when testing or "smelling" for a gas leak is also eliminated.

At street intersections, in the middle of long blocks and at sharp turns in the conduit line large rectangular concrete manholes were built. The sizes constructed were 5 ft. by 7 ft., 6 ft. by 8 ft. and 7 ft. by 9 ft., with 12-in. walls and 6 ft. clear depth. Plenty of head room was allowed so as to permit cablemen, splicers, etc., to work and to leave space for the installation of transformers. Monolithic concrete construction was employed throughout, a 1:3:6 mixture with 1½-in. trap-rock and Portland cement being used. The concrete was put in quite wet and rammed thoroughly, especially next to the form, so as to give a smooth inside finish when the form was removed.

FIG. 4—PLACING MANHOLE CASTING

FIG. 5—SEPARATING DISTRIBUTION CONDUIT FROM MAIN LINE

The frames were made of shiplap, and the hard clay soil eliminated outer forms and sheeting. Section forms were not used, as these required the walls to be built and the form to be taken out before the roof could be put on. The walls and roof were constructed while the one form was in place, and after forty-eight hours this frame was taken apart and removed from the hole. On 5-ft. by 7-ft. holes four 7-ft. second-hand 4.5-in. car rails were used to support the manhole casting and to furnish the bond for the roof. In most cases, owing to lack of room, it was necessary to shelve under the railway conduit line (Fig. 4). In such cases a rail was placed at the corner of the shelf to take part of the pressure of traffic on the manhole head. Short pieces of fiber duct were plugged and placed in walls wherever future outlets might be required.

In building the manholes and distribution holes enough space was left between the walls and parallel gas and water mains to allow joints to be recalked. Circular cast-iron manhole heads with single cover were used, having inside diameter of 36 in. for large holes and 30 in. for distribution holes. A film of cast iron (about ⅛ in.) was left over the locations of perforations when the covers were cast. In time the traffic punctures these thin coverings and the cover becomes truly "perforated." Fig. 4 shows a large casting weighing about 1550 lb. being put in place. The manhole

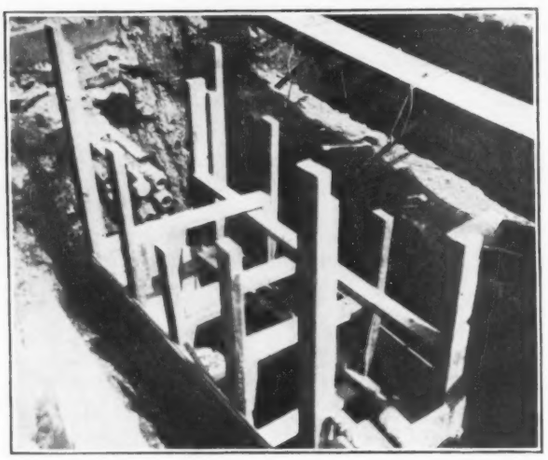


FIG. 6—CONSTRUCTING FORM FOR MANHOLE

heads were set to the grade of the improved street from data given by the county engineer. Monolithic construction is disadvantageous if a head has to be lowered because of street improvement. In such a case the roof of the manhole must be destroyed and the rails let down into the walls the required distance.

No attempt was made to waterproof the manholes, as this is useless unless the conduit line is also waterproofed. Sewer connections were not provided for draining the manholes; instead the water is pumped out when it is necessary to work in them. A cavity is left in the floor of the manhole with the object of facilitating the necessary pumping operations.

Fig. 3 is of interest, as it shows five different styles of underground conduit—fiber, single-tile, multiple-tile, "pump-log" and wrought-iron pipe.

Distribution Holes

Rectangular monolithic concrete distribution holes 3 ft. by 4 ft., with 6 ft. clear depth, 8-in. walls and 6-in. roof and floor, were standard throughout the work. Three ducts of the main line were cut in for distribution purposes, the remaining six ducts being used for transmission work, as shown in Fig. 1, which also shows construction in a nest of pipes (the distribution hole on the right). In this case it was advisable to extend the distribution hole down between the water main and the gas main in order to provide standing room for workmen.

When no cross-overs are used it may be advantageous to cut in the top layer of duct and use only a shallow hand hole for distribution. Fig 5 shows the operation of separating the conduit for distribution work. It was advisable to keep the side wall between the separated duct so as to avoid any possibility of puncturing the duct when installing expansion bolts for angle irons, etc., later.

Services

For services 2-in. wrought-iron pipes were used, generally for three-wire distribution. For long services or where there were several bends to be made 2½-in. pipes were employed. Care was taken in bending the pipes to avoid

COST DATA ON UNDERGROUND CONDUIT WORK

Time occupied, months	4
Average number men	40
Trench feet fiber conduit	9,802
Duct feet	75,700
Average cost per duct-foot (including Telford repaving, supervision and cost of duct)	$0.16
Service duct (wrought-iron pipe), feet	16,108
Cost of services per foot, average (includes cost of pipe)	$0.25
Distribution holes, 3 ft. by 4 ft. by 6 ft	52
Manholes, 5 ft. by 7 ft. by 6 ft. and 6 ft. by 8 ft. by 6 ft	39
Cost of distribution hole, average	$48.00
Cost of manhole, average	$152.00

kinks, as the latter make drawing in of service wires difficult. Generally right-angle "machine bends" were used. A No. 10 steel "drawing-in" wire was left in each pipe of any considerable length or one having more than one bend.

After the service wires are drawn in, the end of the pipe should be cemented or plugged with oakum and compound to prevent gas entering the cellar from the manhole.

Where a street is to be improved and the ordinance prohibits tearing up the street pavement for a period of years it is advisable to run pipes inside the curb to vacant lots and buildings where electricity is not at present used. In cases such as these an arrow is chiseled in the curb or sidewalk at the point where the service enters, the direction of the arrow indicating from which hole the pipe is run. With the aid of a record map and these marks a service can be readily "picked up." The service pipes were laid to drain into manholes or distribution holes.

In running services under patent concrete sidewalks it was convenient to use a trench jack or pipe jack to force the pipe from curb to cellar. This method saves time and leaves the sidewalk unharmed. In rocky soil, however, its advantages are doubtful, as a boulder will turn aside the steel nose screwed into the pipe, and the pipe will not strike the hole cut for it in the cellar wall.

In some cases because of obstacles semi-reamed-out couplings were used on bends, and when these are enveloped in cement mortar they are satisfactory.

Letter to the Editors

The Payment of Employees by Results—A Suggestion

To the Editors of the Electrical World:

SIRS:—One of the noteworthy political developments of the last ten years has been the increase in the socialist and socialist-progressive vote in all the large industrial centers of the world; and it seems to be acknowledged that this is due to the growing discontent of the working and salaried classes with the existing conditions rather than to any increased belief in socialistic theories. The sensational exploitation by the press of the mistakes and business methods of large corporations, the increased cost of living

and the growing feeling of helplessness in an unequal struggle are undoubtedly responsible to a great extent for the large silent following possessed at the present day by men like Eugene Debs, Lloyd-George and August Bebel, It is true that the artisan's wage in the United States has increased appreciably during the last ten years, but he is inclined to feel that this increase has been granted by his employer only through fear of the strength of the unions. The income of the salaried classes has remained practically stationary. These latter have undoubtedly been under pressure, and, feeling it acutely, they have an ill-defined belief that they have not had their due share of the phenomenal prosperity enjoyed by the country during recent years. With such beliefs increasing and fermenting among the classes which should be the backbone of the nation, an economic or political upheaval would seem to be only a question of time, and the longer it is delayed the more violent it will probably be. The able, "stand-pat" policy of the conservative oligarchy that dominated England almost continuously for twelve years after the retirement of Gladstone has been finally swept aside by the wave of radicalism under Lloyd-George, and it is possible the political life of the United States will experience an even more extreme change if the condition and feeling of the masses remain as they are at present.

The increasing power of the unions, the support they are receiving all over the world in spite of some of their unscrupulous actions, and the formation of societies for the protection of mutual interests among the salaried employees in some of the large manufacturing firms in Germany, together with the talk of similar developments in America, are surface indications of the growing indifference and even antagonism of their employees which the large corporations have felt for a long time. The pension systems introduced during the last few years by some of the large railroad and industrial interests and the selling of stock to employees under favorable terms have been among the first crude attempts to combat this growing evil in America. It would seem that the co-operative principle, by which the employees are at the same time the owners of the firm, should offer theoretically an ideal remedy for this discontent. But, although this system has been successful in a few cases, the impossibility of securing men of the necessary ability, character and standing for the management has resulted in a long series of failures. The holding of a few shares in the stock of a large corporation by its employees is of doubtful value, as it is seldom long before the employee feels that any additional effort on his part will have little effect on the prosperity of a large company. German firms have, in consequence of this, discouraged such holdings as having a tendency to introduce stock gambling among their employees.

On account of the severer competition and greater growth of socialism abroad, this question of the unsatisfactory relationship between the employee and the employer has been forced upon the attention of manufacturers in Germany to a considerably greater extent than has been the case in America. The remedy they have most generally adopted has been the introduction of a bonus system of payment of employees by results, combined with a system of old-age pensions, the intent of the latter being to give stability to the organization and to induce the employee to remain with one firm rather than to change whenever a favorable opportunity presents itself. The pension arrangement is a simple one to work out; but the payment by results is on the other hand very difficult, as the system of payment must be equitable to both the manufacturer and the employee, while the method adopted for judging of results must be such as to hold the confidence of the latter, who looks with distrust on any new proposition from his employer. With an artisan employed to a great extent on duplicate work, the question of payment by results is usually a simple one, and a piece work or premium system, if ably and conscientiously administered, offers good possibilities when the opposition of the unions and the natural distrust of the men have been overcome. The amount of work produced by a mechanic can be readily determined and its quality examined at any time, if some adequate system of shop accounting and inspection is in force; but with the foremen, office force and salaried employees generally the proposition becomes much more difficult. These latter have in consequence been generally given, under such systems of payment by results, a bonus on the profits made or on the business done by the firm or by the department in which they are located. Such an arrangement works out well enough in a small concern where the management can be in close and intimate touch with the employees and their work, but for the large corporations which have grown up in recent years the results have been less satisfactory, as the size and complexity of the organization seem to render difficult any cordial relations or mutual understandings between the management and the employee.

It has been a disappointment to stockholders that the large manufacturing corporations formed during the last ten years have not been more successful. With their immense financial powers and with their sales policy facilitated by influential connections, it has frequently been found that the expected economies of manufacture were not realized, and that these corporations have at times had difficulties in meeting satisfactorily the competition of their smaller and more efficient rivals. It seems now to be recognized that the increase in size of a manufacturing concern beyond a certain point tends to lower its efficiency, on account of the increased complication and on account of the inevitable deadening effect of a large organization on the personnel. For this reason it appears probable that the large manufacturing corporation of the future will consist of a number of small factories, each complete in itself and manufacturing a single specialty. Such a decentralized organization, consisting of a number of small units, each with a system of payment of employees in proportion to the productiveness of their work, which would be judged by some unequivocal system in which the employees would have complete confidence, would undoubtedly result in a marked improvement in tone and would enable the firm to combine to a great extent the advantages of a large and those of a small organization. Under this system the employees would probably receive a comparatively small fixed cash salary, together with a bonus on the profits made by their particular factory, and once the organization was in operation, with the employees satisfied that the management was both able and willing to treat them fairly and liberally and to support a system of payment according to results, the success would in all probability be surprising. It would undoubtedly require time to carry out the details of such a system in any particular case, but the fact that the whole organization would have an incentive to work with the one end in view would facilitate the mutual adjustment that would be necessary.

The introduction of any system of payment of *all* employees in proportion to the productiveness of their work, as a means of improving the tone and efficiency of a large organization, is undoubtedly a difficult problem; and it is hardly to be wondered at that the management is usually discouraged by the magnitude of the task and the opposition encountered from the conservative element. But the situation seems to be gradually becoming more acute, so that the growing discontent and socialistic feeling, with their effect on the political situation, on the one hand, and the comparative inefficiency of the average large organization, on the other, will in all probability before long convince the interests controlling the policy of the large corporations concerning the necessity that exists for pushing the introduction of some such system capable of producing more satisfactory results.

Pittsburgh, Pa. WILLIAM L. WATERS.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Remedying Trouble Caused by Varying Voltage

Motors are often operated from street railway circuits on which there is a wide variation in voltage during the day, corresponding to the variation of the load on the street railway system. In one case a compound motor, rated normally at 550 volts, was used to drive a centrifugal pump taking water from a deep well to augment the water supply of a city. There was a variation of about 100 volts from the highest to the lowest voltage during the day at the panel controlling the motor. This caused the motor to run above normal speed on the higher voltage, and as the load on the pump corresponding to this speed was too large for the motor to carry, trouble was constantly experienced from the opening of the circuit-breakers. The load on a centrifugal pump under constant head is of such a character that a slight increase in the speed of the pump causes a large increase in the load on the motor. After making tests it was decided to increase the number of turns in the series field coils so that when the motor was running at normal voltage, and consequently at normal speed, more of the excitation would be supplied by the series field coils than formerly, and by placing a rheostat in the shunt field circuit, the excitation from the shunt coils was decreased, the total excitation remaining the same as before at normal voltage. When the higher voltage occurs the increased current has a greater effect on the field than formerly, owing to the greatest number of series turns, and the speed is not increased enough to change the load materially.

Parallel Operation of Alternators with Composite Windings

By R. L. Mossman

In general it is more difficult successfully to operate in parallel alternators having composite windings than any other type, and some experiences of the author in connection with working out a scheme for accomplishing such a condition may be of interest. The prime movers of the plant in question were two reciprocating steam engines with shaft governors which could not be adjusted while the engines were running, and the generators were of the 150-kw, 2200-volt, two-phase revolving-armature type directly connected to the engines.

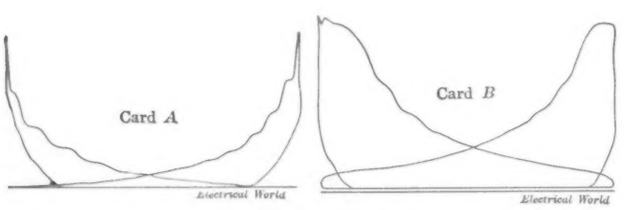


FIG. 1—INDICATOR CARDS BEFORE CHANGES WERE MADE

The unequal division of the load on the two machines as they were at first operated is very well illustrated by the indicator cards shown in Fig. 1, card A being taken from engine No. 1 and card B from engine No. 2. At this time engine No. 1 had a speed variation from no load to full load of about 1 per cent, while the regulation of No. 2 was about 2 per cent. It was found that if each engine were allowed a wider variation the operation was more satisfactory, and the governors were accordingly set to give a regulation of about 4 per cent. In addition to this the dashpots on the governors were filled with an oil sufficiently heavy to prevent the engines from responding to the spasmodic surges in the load and still not heavy enough

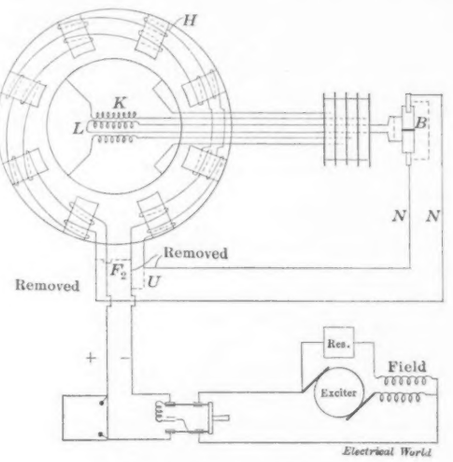


FIG. 2—DIAGRAM OF CONNECTIONS

to prevent their response to the bona fide changes that might occur. These changes greatly helped the operation but it was still unsatisfactory.

It was then deemed advisable to look into the electrical end of the equipment and see what changes might be made there which would be beneficial. In Fig. 2 one of the alternators and its immediate connections are shown diagrammatically. The compounding effect of the auxiliary field winding *H* in this type of machine is the same as the effect of the series winding of the compound-wound, direct-current generator. Thus when the load is increased the current in the primary winding of the series transformer *K* is increased and a greater current is produced in the secondary *L*. Since the energy from the secondary winding is taken through the commutator at *B* and after being changed to direct current is conducted to the auxiliary field winding through the leads *N N*, it is seen that any increase in load will in turn cause an increase in voltage, and a decrease in load will have the opposite effect.

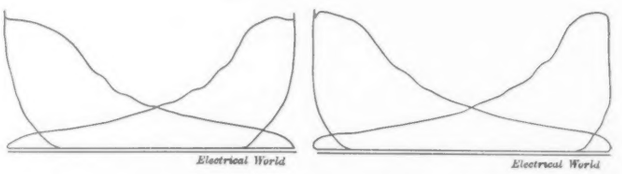


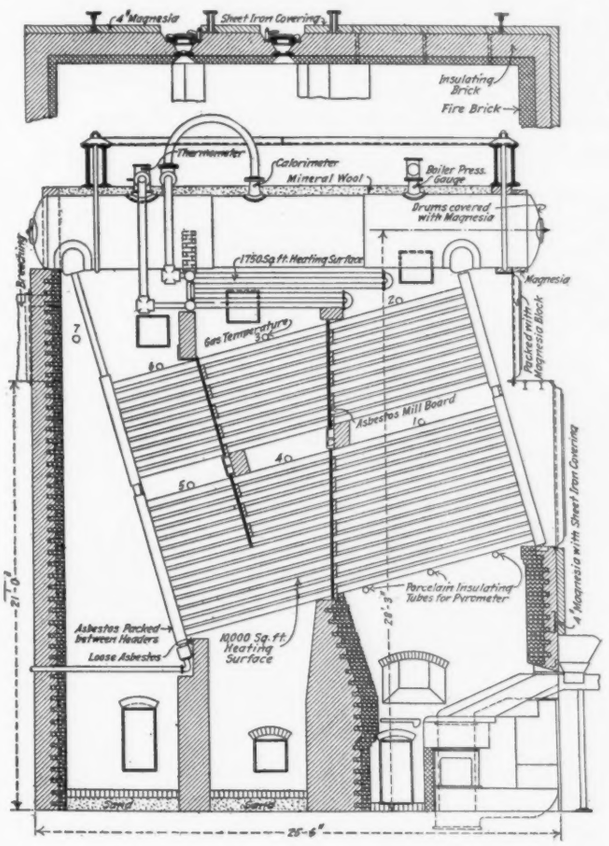
FIG. 3—DIVISION OF LOAD AFTER CHANGES WERE EFFECTED

As the exciters on the system were loaded to approximately only 60 per cent of their rating, it was decided to raise the brushes on the commutator *B* and place the composite field coils in series with the other winding, as shown by the dotted lines marked *U* and *F*. Following this the operation was highly satisfactory and any cross-currents

that developed could always be eliminated by proper attention to the governors. The indicator cards shown in Fig. 3 were taken almost simultaneously from the two engines after these changes had been made and when compared with those in Fig. 1 show how well the load has been equalized.

Test of a 1000-hp Boiler Twenty-four Tubes High

Mr. B. N. Bump, of Syracuse, N. Y., presented an account of some tests run on a 1000-hp Babcock & Wilcox boiler, twenty-four tubes high, before the American Society of Mechanical Engineers, New York, Dec. 4, the investigation having been carried out to determine the advantages and disadvantages of using such an unusual height of tubes in a boiler of this type. The tests represented continuous operation in the regular service of a large plant, and they were continued from November, 1911, to



LONGITUDINAL ELEVATION OF 1000-HP BOILER

February, 1912. Among the points especially studied were the efficiencies at various ratings, the economy of the superheater when located above the twenty-fourth tube, effectiveness of the final boiler pass, and comparison of the exit-gas temperature with that of the steam.

A Foster superheater was placed between the top row of tubes and the boiler drums, and the gases entered the superheater after passing over twenty-four tubes. The superheat was found to go up with the boiler rating, increasing from 30 deg. to about 75 deg. Fahr. for a change in rating from 55 to 120 per cent.

The fuel was burned on a six-retort Taylor stoker having a grate area, exclusive of dump grate, of 62.5 sq. ft. One of the results of increasing the height of a boiler is a large ratio of boiler heating surface to grate area, which in this case was 160 to 1. Such a large ratio limits the capacity of the boiler, making it impossible to run at high boiler ratings.

The best combined efficiency, 81.3 per cent, was obtained at about 56 per cent of rating. The efficiency decreases slowly with an increase in the boiler rating. The low rating tests show exit gas temperatures but little above the temperature of the saturated steam in the boiler. The radiation losses are low considering the exposed condition and the low atmospheric temperatures surrounding the unit.

Choice of Motor Field Windings for Various Duties

In his paper on field coils, presented before the Association of Iron and Steel Electrical Engineers at Milwaukee, Oct. 1, Mr. R. B. Treat, of the Crocker-Wheeler Company, Ampere, N. J., included a tabulation of the different motor field windings best adapted for various classes of drive where the duty required of the motor is continuous, intermittent, uniformly loaded, or reversing. In several cases, as the following table indicates, a combination of shunt and heavy series would be preferable, but for practical reasons and continuity of service, entire series may be required.

Boring mill	Shunt
Car dumper	Dependent upon dumper design
Centrifugal blower	Shunt, or light series and shunt
Centrifugal pump	Shunt, or light series and shunt
Conveyor table—	
Continuous light friction	Shunt and light series
Continuous heavy friction	Series, or shunt and heavy series
Reversing and intermittent	Series, or shunt and heavy series
Crane hoist, trolley and bridge	Series
Draw bench, continuous chain	Shunt and light series
Draw bench, reversing	Series, or shunt and heavy series
Drill press	Shunt
Hydraulic press	Shunt
Lathe	Shunt
Ore unloader	Series
Pipe threader	Shunt
Pipe welding	Shunt and light series
Planer, shifting belt—	
Constant speed	Shunt and light series
Adjustable speed	Shunt
Reciprocating pump	Shunt, or light series and shunt
Roll mill, feed tables	Series, or shunt and heavy series
Roll mill, screw down	Series, or shunt and heavy series
Saw	Shunt and light series
Shaper	Shunt
Shear, without flywheel	Shunt and heavy series
With flywheel	Shunt and heavy series
And if sufficient friction	Series
Slotter, constant speed	Shunt and light series
Slotter, adjustable speed	Shunt
Straightener	Shunt and light series.
Transfer	Series, or shunt and heavy series

Employer's Right to Employee's Invention

Upon what ethical or legal grounds do some manufacturers base their rights to all improvements and inventions made by an employee who receives no compensation other than wages, even though the invention be conceived and developed outside regular working hours? It is said that some concerns require all skilled employees to sign a contract assigning to the firm without compensation all right to any invention made along the line of manufacture, and that this contract is binding even after the inventor has left the employ of the company. Such conditions seem discouraging to the production of improvements by employees and an injustice to the workman hired at nominal wages. A. L. P.

It is difficult to state just what arrangement a company should make with its employees concerning inventions conceived by them. However, there can be no doubt whatsoever that if a person enters into a contract with a company to accept a certain amount of compensation for his services, and to assign to the company whatever invention he may make during his employment, he is bound both legally and morally to comply with his part of the contract just as the company is compelled to pay to the employee the amount of wages agreed upon. No one is compelled to enter into a contract with a company unless he at the time considers it advantageous to do so. Having once made the contract, he should live up to its provisions just as he expects the company to fulfil its part of the contract. It can hardly be agreed that the inventive employee will receive only bare wages, because if he has a real inventive instinct he will become of great value to his employer or to a competing employer, and his wages will be determined by this value rather than by the amount paid to an ordinary workman.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Armature Reaction.—W. Lulofs.—A continuation of his mathematical article, illustrated by diagrams, on armature reaction in lap-wound machines. The circulating currents in a lap-wound armature due to unequal pole strengths are usually supposed to produce an armature reaction largely tending to remedy inequalities in the magnetic field. The author shows that only in the case of the four-pole machine is this counterbalancing true. This is in agreement with the fact that the four-pole lap-wound machine is superior to those having more poles.—London *Electrician,* Dec. 6, 1912.

Induction Motors.—E. Boulardet.—The first part of a mathematical article on the calculation of the axle and the stator of induction motors of large diameter.—*La Revue Elec.,* Dec. 6, 1912.

Speed Regulation of Small Motors.—H. Barkhausen.—An article illustrated by diagrams on the most suitable connections of the resistor employed for regulating the speed of small motors in laboratory practice within very wide limits.—*Phys. Zeit.,* Nov. 15, 1912.

Vibrating Rectifier.—W. A. Brackett.—An illustrated description of a simple device for mechanically changing alternating current of standard voltage to low-voltage direct current, especially for use with automobiles.—*Elec. Journal,* December, 1912.

Lamps and Lighting

Drawn-Wire Filament Mounting.—A note on a recent British patent (No. 1180, Dec. 5, 1912) of T. W. Lowden. To support the filaments of incandescent lamps so that they may expand and contract without damage and may withstand shocks, the filament is formed into a zigzag, and a portion of the bends are then short-circuited so as to form a loop from the contact point. It may further, if desired, be twisted into a rope or may have its sides welded together. These loops may be bent over both at the top and base of the zigzag and the ends may be secured directly to the central glass support. If only one end is secured in this way, ordinary methods may be employed at the other.—London *Elec. Eng'ing,* Dec. 12, 1912.

Stability of the Electric Arc.—G. W. Roose.—An article discussing the subject under the following headings: Normal arc, sustaining power, rigidity, abnormal arc, inherent properties, reducing stability, results produced by various forces acting upon the arc, action of several arcs on one another, action of magnetic fields.—*Elec. Journal,* December, 1912.

Lighting of Industrial Establishments.—A. J. Airston.—The author first discusses the different items on which the design for an illuminating system depends, namely, the height or type of ceiling or roof, the class of work carried on in the location, the character of the surroundings, the area and shape of the location, the illuminating system to be replaced (if any) and the cost of the installation. He then gives some simple rules how to proceed in laying out the lighting system, and illustrates these rules by two examples from practice.—*Elec. Journal,* December, 1912.

Generation, Transmission and Distribution

The Grounding of the Neutral.—An account of the extended discussion which followed J. S. Peck's British I. E. E. paper, recently abstracted in the *Digest,* both in the London and the Manchester meeting. Mr. Brazil suggested that it is desirable to insert between the neutral and earth a resistor with a negative temperature-resistance coefficient. He described a resistor built up of seventy-two rectangular fireclay troughs containing carbon powder, arranged eight sets in parallel, each set consisting of nine in series and giving 200 amp with a fault. Mr. Partridge pointed out the desirability of providing a definite metallic path back to the generators, when the outer of a high-tension cable is grounded at the station and the middle point of the transformer secondary is grounded at the substation. If a spark-gap is provided at the distant end of the high-tension line, between the outer and earth, then, in the event of a connection between the primary and the secondary of the transformer, there will be a metallic return by way of the spark-gap, obviating the necessity which would otherwise exist of a considerable current through the ground to the station. Mr. Partridge, following the single-phase practice, grounds one phase of his three-phase system throughout. Mr. S. L. Pearce said that at Manchester they started in 1901 with ungrounded neutrals and that the arrangement continued to the present day. The problem had not been studied then as now, and it is, no doubt, considered that the insulated system is safer and that it offers the possibility of running with one phase grounded. This has been borne out in practice. Under present conditions, however, there is nothing to choose between one system and the other at Manchester, and it has been decided to ground the neutral at an early date in order to limit the current to earth. As there is 45,000 kw at Stewart Street, behind a fault, the switch which interrupts the circuit is subjected to severe treatment. He proposed to combine grounding through a high-resistance resistor (giving about 100 amp) with balanced protective gear. The resistance would be proportioned to allow sufficient current to trip the largest circuit-breaker. Mr. J. S. Peck, in closing the discussion, asked whether there is any change in the resistance of the carbon resistor referred to by Mr. Brazil and was informed that there is not. In many cases, he said, manufacturers are able to make considerable reduction in cost of apparatus where grounding is adopted owing to the limit voltage, but he does not favor this, because apparatus should be capable of working ungrounded if necessary. In regard to overhead lines, if it is only a case of a pierced insulator, he saw no reason why the line should not be grounded at the station and run. In the case of a low-voltage system it does not matter whether one phase or the neutral is grounded, but with a step-down transformer it is better to ground one phase than to work ungrounded. The tendency on very high-voltage systems seemed to be toward insulated neutrals and the use of delta-connected transformers. He thought it doubtful whether grounding should be adopted with the 200-volt or 400-volt supply systems in large industrial works, as it is necessary to keep going and impossible to shut down for temporary grounds which frequently occur.—London *Elec. Review,* Dec. 6, 1912.

Peat.—J. Teichmueller.—A continuation of his paper read before the German Association of Electrical Engineers on peat and electrical engineering. The author describes the electric transmission plant in Ostfriesland, Germany, making use of large peat deposit. There are three turbo-generators, two of 1250 kva each and one of 1550 kva. The

author begins describing the methods of mining the peat.—*Elek. Zeit.*, Dec. 12, 1912.

Determination of Capacities.—J. W. WOODROW.—A mathematical paper on the determination of capacities by means of conjugate functions. Among the problems solved is the determination of the capacity of a three-phase overhead system in which the wires are arranged so that they are on the corners of an equilateral triangle and the determination of the capacity of a three-core cable of the cloverleaf type.—*Phys. Review*, December, 1912.

Traction

Future of Electric Traction.—H. LABOUR.—In an article on the future of electric traction the author says that the three-phase system has probably only a very limited future. The fight is between the high-tension direct-current system and the single-phase system. The latter has made rapid progress in recent years and seems destined to still greater development. The author thinks that for distances up to 40 km (24 miles) the direct-current high-tension system may be recommended. For longer lines the single-phase system has no competitor.—*La Lumière Elec.*, Dec. 14, 1912.

Gasoline-Electric Automobiles.—A note on a recent British patent (No. 2817, Dec. 5, 1912) of MacFarlane Engineering Company, Ltd., and W. A. MacFarlane. There are two direct-current machines with their armatures in series. One member of the primary machine is coupled to the prime mover and the other to the driven shaft. On the auxiliary machine one member is coupled to the prime mover and the other is fixed. Exciting windings on the poles of both machines are so connected that the voltage produced in each armature acts in the same direction round the main circuit. There are series windings on the poles of the auxiliary machine so arranged that the voltage due to them opposes that due to the exciting windings. The mid-point of the series-connected exciting windings is brought out for the purpose of reversing one of them.—London *Elec. Eng'ing*, Dec. 12, 1912.

Interpole Motors.—LEHRMANN.—A French translation of his paper presented before the German Association of Tramways and Light Railways on the results obtained with interpole motors in actual traction.—*La Houille Blanche*, November, 1912.

Electrification of Main Lines.—The first part of a long paper on the electrification of trunk railroads. In the present instalment the author discusses the different systems and expresses himself in favor of single phase.—London *Electrician*, Nov. 30, 1912.

Installations, Systems and Appliances

Mixed Private and Municipal Stations.—RICHARD PASSOW.—While in Germany public opinion was formerly very much in favor of municipal ownership there has been a change in recent years. Privately owned plants are again increasing in number. But the most significant development is the evolution of the mixed private and municipal plant. The first case was the Rhenish-Westphalian Electricity Works in Essen. Since 1902 this station has undergone a steady and rapid enlargement, and when it undertook to acquire all the street railways in the industrial district in the neighborhood the cities and counties concerned decided to acquire some stock in the electricity works. This was done by three cities and eleven counties, each of them having a representative in the board of directors. A sketch is given of other mixed private and public stations. In some of them the city is the majority stockholder, in others the majority of the stock is held by private parties. Most cities and counties are chiefly interested in having a representative in the board of directors, while the business management and the executive officers are left to the private parties. The author thinks that the mixed private and public electricity works will become even more important in the future.—*Elek. Zeit.*, Dec. 12, 1912.

Italy.—An editorial on the enormous development of the electrical supply industry in Italy during the last few years. From 1899 to 1908 there have been built in Italy 3364 new stations with an aggregate rating of 436,000 kw. At the end of 1908 there were in operation in Italy 6750 stations with a total rating of 510,000 kw, of which 360,000 kw was furnished from water-power. In contradistinction the manufacturing electrical industries have not developed to a similar extent in Italy. Out of 5953 stations installed in ten years, 3329 stations were equipped by foreigners, especially by German firms. Some general questions relating to this situation have been discussed by Legouez, who concludes that the chief disadvantage of Italy as a manufacturing country is that it is obliged to buy some of the most important raw materials, especially iron, from foreign countries. Sixty-seven per cent of the value of the electrical imports to Italy comes from Germany, only 5 per cent from France. This is thought to be due to the influence which Germany has on the banks and financial institutions of Italy.—*La Revue Elec.*, Dec. 6, 1912.

Tariff.—BERKOVITZ.—In view of the many advantages of the flat rate the author thinks that the following limiting device made by a German company will be found suitable. It limits only the watts used for lighting, but the momentum of inertia of the movable armature is so chosen that it prevents the lighting current exceeding a predetermined amount, though it does not prevent the use of cooking and heating apparatus. For instance, if this limiting device is adjusted to 100 watts for lighting it is nevertheless possible to use 300 watts and more for cooking and heating. When the lighting current is used the heating and cooking apparatus cannot be used.—*Elek. Zeit.*, Dec. 12, 1912.

Argentine.—A. H. GIGGINGS.—The first part of a statistical article on the industries and industrial conditions in the Argentine, giving data of imports from different countries and tables of various industrial works and factories in the Argentine.—London *Elec. Review*, Dec. 13, 1912.

Electrophysics and Magnetism

Volta Effect.—F. SANFORD.—The fundamental question as to the nature of the Volta effect seems to be whether the different metals when in electrical contact with the earth or with the inside of the same hollow conductor are still at different potentials relative to each other, or whether the potential difference which may be observed between two of them when they are brought very close together is due to some kind of electrolytic polarization in the medium between them. The author describes a series of experiments from which he concludes that the Volta effect is not due to any electrolytic action between the opposed metals, but different metals when in contact with the earth or with the inside of the same hollow conductor may be at different potentials relative to each other.—*Phys. Review*, December, 1912.

Magnetic Resolution of Fine Spectral Lines in the Vacuum Arc Lamp.—C. H. WANI-MOHAMMED.—An account of an investigation in which the author studied the Zeeman effect exhibited by certain fine lines of bismuth, cadmium, thallium and zinc. For this purpose he used a modified form of Janicki lamp and an excellent echelon spectroscope. The general conclusions are as follows: It was found that the Janicki type of oxide cathode lamp gave very fine, intense satellites so that it became an excellent source for studying the Zeeman effect. A few satellites were investigated for the first time. Some of the satellites were resolved by the magnetic field into three, four, five, six and even nine components. In general, the separation was proportional to the magnetic field strength. One companion line of cadmium $\lambda = 4800$ gave an extraordinary type of resolution. Another satellite of this principal line showed that the law of displacement changed as the intensity of field was increased. The cadmium line $\lambda = 4678$ has satellites which are visible in the magnetic field but

which cannot be seen under ordinary conditions. The bismuth line $\lambda = 4722$ has a very complicated structure, and two of its satellites suffer a magnetic displacement which is proportional to the square of the field strength. Finally, the author found that the resolution of sufficiently fine lines could be measured in very weak fields, such as 300 gauss.—*Ann. der Physik,* No. 11, September, 1912; abstracted in *Amer. Journal of Science,* December, 1912.

Weight and Charge of Condenser.—P. G. Agnew and W. C. Bishop.—An account of an experimental attempt to detect possible changes in weight or momentum effects on charging a condenser. The results are negative and are summed up as follows: Charging a 10-mf condenser to 240 volts was found not to change its weight by as much as 0.01 milligram, or one part in 100,000,000. In charging and discharging the same condenser no momentum effect having opposite signs on charge and on discharge as great as 0.01 dyne-second was detected. Similarly no momentum effect having the same sign on charge and on discharge as great as 0.0004 dyne-second was detected.—*Phys. Review,* December, 1912.

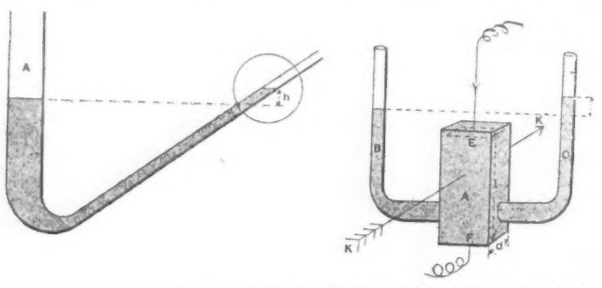
Two Spherical Electrodes.—G. R. Dean.—A mathematical paper on the potential and electrostatic force in the field of two metallic spherical electrodes.—*Phys. Review,* December, 1912.

Electrochemistry and Batteries

Electric Furnace Electrodes.—A note on a recent British patent (No. 14,267, Dec. 5, 1912) of the Planiawerke. The metal core and the electrode bore are so adjusted that the contraction during solidification of the metal or alloy cast in the bore causes the metal to be firmly pressed against the surrounding wall of the electrode.—London *Elec. Eng'ing,* Dec. 12, 1912.

Units, Measurements and Instruments

Measurement of Magnetic Fields.—P. H. S. Kempton.—An illustrated article on various methods of measuring magnetic fields. The author first discusses magnetic methods—(a) magneto-metric methods in which deflections and oscillations of magnetic needles are observed; (b) a second magnetic method, that of Quincke and Dubois, which depends on the variation of pressure at right angles to the right of forces with the permeability of the medium. Fig. 1 illustrates the



FIGS. 1 AND 2—METHODS OF MEASURING MAGNETIC FIELDS

principle of the method. *A* is a V-tube containing a liquid of known permeability; Du Bois used nickel sulphate and water. A magnetic field is applied to the narrower limb, so that the lines of force pass parallel to the liquid surface, some in the liquid and some above it. The pressure at right angles to the lines of force, and hence at right angles to the surface of the liquid, is $\mu H^2/8\pi$ in the liquid and $H^2/8\pi$ in the air above. The difference of pressure $(\mu - 1)\, H^2/8\pi$ causes the liquid to rise in the narrow limb until equilibrium is established; that is, when $(\mu - 1)\, H^2/8\pi = h\rho g$. By tilting the tube as shown in Fig. 1 and reading the elevation of the column by means of a microscope, Du Bois rendered this apparatus more sensitive and capable of measuring fields of strengths from 500 to 10,000 gausses, with an error of less than half of 1 per cent. The second class of methods uses electromagnetic effects: (a) The induction of current in a conductor moving in a magnetic field is used in the earth inductor and search coils. (b) The motion of a conductor carrying current in a magnetic field is used in the instrument shown in Fig. 2. The force exerted by a magnetic field of strength H on a conductor of length L carrying a current of C c. g. s. units is given by the product $H\,C\,L$. The central rectangular cistern A is connected to side tubes B and C; all contain mercury. Current is led in at the top of A by an electrode E and passes out at F. The magnetic field is applied across the cistern, as shown by the arrows $K\,K$. The resulting force on the conducting fluid $(H\,L\,C)$ is transmitted to the side tubes, and the mercury rises in one of them until equilibrium is reached; that is, when $H\,C\,L = h\rho\, g\, \delta\, L$; where δ is the density of mercury, g the gravitational acceleration, and L the section of the mercury perpendicular to the magnetic field. (c) The variation of electric resistance with magnetic field intensity is used in pure bismuth wire coils. Finally, optical methods are considered. In summing up the author thinks that the electromagnetic effects are the most fruitful of practical methods for measuring magnetic fields of all strengths, and that the search coil and bismuth coil are the most likely to serve practical purposes satisfactorily. Finally, a few notes are given on the measurement of rapidly changing field intensities.—London *Elec. Review,* Dec. 13, 1912.

Telephone Receiver in Alternating-Current Zero Measurements.—Phillips Thomas.—A paper in which the author describes a method of employing the watchcase telephone receiver in the comparing of capacities by the alternating-current bridge method. The use of this scheme does away with the difficulties ordinarily encountered in attempts to use the receiver in this way. The success of the method is due to the fact that the human ear is much more sensitive to a noise or sound of very low frequency, in the presence of a barely audible note of high frequency, than to the latter alone. By this method, which is here denominated the "method of beats," such a receiver may be used to balance an alternating-current capacity bridge (1) on frequencies too low to affect the ear sensibly and (2) in cases where the time-constant balance is a function of the current strength in the bridge circuit. Simple means are suggested for the ready application of the method to commercial as well as to laboratory measurements.—*Journal of the Franklin Inst.,* December, 1912.

Telegraphy, Telephony and Signals

Three-Plate Condenser.—E. Grueneisen and E. Giebe.—An article on the determination of the dielectric constants of solid insulators, like porcelain, etc. With a two-plate condenser certain precautions are necessary and several corrections must be made. With a three-plate condenser, for the capacity of which a new formula is given, fewer precautions are necessary and the corrections are also smaller.—*Phys. Zeit.,* Nov. 15, 1912.

Submarine Telephone Cables.—J. G. Hill.—The conclusion of his long paper on the loading of submarine telephone cables giving a comparison between Pupin-coil-loaded and continuously loaded cables. Tables and diagrams are given showing comparative costs. According to the author it appears clear that a coil-loaded cable is of greater electrical efficiency and therefore is to be preferred to a continuously loaded submarine cable, if it can be satisfactorily maintained. It follows from the nature of the case that it is not possible to state absolutely the life of such a cable, and this is, of course, a necessary consequence of its recent introduction, but the Anglo-French loaded cable has now been immersed nearly two and one-half years and has not yet required any attention whatever. The Anglo-Belgian cable also has not been interrupted since it was handed over to the post office authorities by the contractors. Those who have the greatest knowledge of the design of such cables, moreover, do not anticipate any exceptional difficulty in the future. So far as continuous loading is concerned, con-

siderable attention has been, and doubtless will continue to be, devoted to its development, but even if it be assumed that material progress is made, now or at an early date, the increase in the diameter of the conductor brought about by the iron wrapping, and the necessity for an increased weight of gutta percha as compared with a coil-loaded cable, would in any case appear to be a serious drawback. The type of continuous loading examined in this paper, that produced by the Telegraph Maintenance & Construction Company, represents good work in that direction, inasmuch as the speaking range of the cable so loaded was rather more than doubled as compared with an unloaded cable. It will, however, be necessary to decrease the ratio of resistance to inductance and to increase considerably the permeability of the iron winding before continuous loading can be considered to be electrically equal to coil loading as an efficient electrical device.—London *Elec. Review,* Dec. 13, 1912.

Artificial Telegraph Line.—K. W. WAGNER.—The first part of an illustrated paper in which the author describes a new artificial line for the investigation of telegraph currents. The line is made up of resistors, Pupin inductance coils and condensers. The construction is described in some detail and the phenomena on this artificial line are shown to be quite analogous to the phenomena of real long lines. The author discusses the currents at different points of a long line and the effect of inductance. The article is to be concluded.—*Elek. Zeit.,* Dec. 12, 1912.

Miscellaneous

Future of Electricity.—MAURICE LE BLANC.—The great problem of the future is the direct transmission of heat into electricity. From the viewpoint of immediate practical importance, however, the greatest developments are to be expected from energy transmission. Energy transmission by means of waves without wires is a very interesting problem, but from ordinary transmission with wires it seems that agricultural districts will profit most in the near future. A problem in this respect is what the highest voltage that can be used in practice will be. As to overhead lines versus cables, the cable seems to have a promising future, especially for direct current and for alternating current of very low frequency. The direct-current high-tension Thury series system may come into favor again, as it will permit the use of cables instead of overhead lines without any danger from capacity currents or resonance phenomena. As to the alternating-current system, the author thinks it will expand chiefly in the form of three-phase currents. The lower the frequency the easier are the large transmission schemes. A three-wire lamp with three filaments supplied with energy from three phases does not suffer in its light-giving qualities from a low frequency. In machine design Le Blanc is working at present on the realization of some important novelties. His studies on rotary compressors have led to the design of machines of very high speed, actually up to 37,000 r.p.m. The secret of the design consists in the very great liberty of movement of the rotary axle and in the use of automatic equilibrators.—*La Lumière Elec.,* Dec. 14, 1912.

Book Reviews

TRANSMISSION LINE CONSTRUCTION. By R. A. Lundquist. New York: McGraw-Hill Book Company. 285 pages, 180 illus. Price, $3.

The title aptly indicates the nature of the matters dealt with in the pages of this book. The up-to-date methods of planning and constructing transmission lines are clearly described, and the numerous illustrations which supplement the text have been wisely selected. The author has presented prices and cost data that are of great value to every practical engineer engaged in transmission-line work, and he offers these figures in such a manner that they may be of real use to the reader. Mr. Lundquist has taken great pains to enhance the value of all cost figures by giving such information as he deems necessary for their proper understanding. Information of the kind given here is available from various sources, but we do not know of any other one publication in which so much useful cost data on transmission line construction has been collected or in which it has been so intelligently presented. As stated in the preface to the book, the author does not attempt to cover the electrical and mechanical calculations involved in the design of high-tension transmission lines: "the book treats the subject from the standpoint of the construction man rather than that of the office engineer." This does not mean that the book is not of value to the man who makes the necessary calculations, because his end always is, or always should be, an economic one; and the material as presented by Mr. Lundquist cannot fail to be of interest to him.

Where the author states his own personal opinions we are generally inclined to agree with him, as, for instance, when he says that the actual planning and systematic preparation for the carrying out of a transmission-line project deserve more attention than has usually been accorded to them in the past, and when he recommends on economic grounds that more attention be paid to the proper seasoning and treatment of wooden poles. When dealing with specifications for wooden poles the author appears to criticise adversely the not uncommon practice of specifying the top diameter and the length of poles only, without making mention of the required butt measurement; but is it not true that a cause beyond the will of man determines the average "natural taper" of each particular variety of tree suitable for transmission-line poles, and is it not, after all, best to let the butt measurement take care of itself? It is not suggested that strength calculations on poles for the more important transmission lines should not be made, but such calculations should be based on the known natural taper of the selected timber.

Among the best portions of the book may be mentioned Chapters II and VII, the former because it is original and explains in concise language the author's own views as to the proper way to lay out a transmission line, and the latter because it sums up the case for the concrete pole and clearly explains the modern methods of manufacturing and erecting these poles.

PRINZIP UND WIRKUNGSWEISE DER WATTMETER UND ELEKTRIZITÄTSZAHLER FÜR GLEICH UND WECHSELSTROM. By Alex. Konigswerther. Leipzig: J. A. Barth. 71 pages, 84 illus. Price, 3.30 marks.

A well-illustrated little descriptive treatise on wattmeters, watt-hour meters and similar instruments. The fundamental principles of each instrument are indicated, the connections with the circuit are clearly and diagrammatically shown, and the relative advantages of the different types summed up. The book will be of service to students of elementary electrical engineering, and particularly to those interested in German meter practice.

DIE ELEKTROLYTISCHE ALKALICHLORIDZERLEGUNG MIT STARREN METALLKATHODEN. By Dr. Jean Billiter. Halle a.d.S: Wilhelm Knapp. 265 pages, 189 illus. Price, 16.50 marks.

The first volume of a treatise on the electrolytic decomposition of potassium and sodium chlorides. In this volume the author compiles, describes and discusses the various processes for these electrolytic industries as they appear in German, British and American patents up to a recent date. The author has contributed to this art, and his own patents are included in the discussion. The book will be of interest to all students of this branch of electrochemical industry, especially from the inventor's standpoint.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Push-Button and Lock Wall Switches

The new push-button wall switch marketed by the Manhattan Electrical Supply Company, 17 Park Place, New York, is provided with an irremovable dust-proof fiber cover, which also acts as an insulator and is held permanently in place by the cross-bar. This cover effectually incloses and protects the switch mechanism from coarse dirt

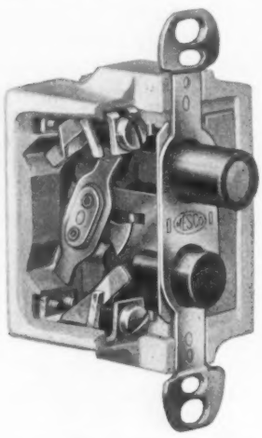


FIG. 1—PUSH-BUTTON SWITCH

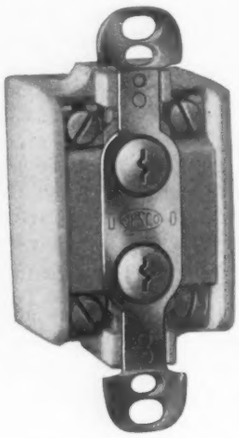


FIG. 2—LOCK SWITCH

and grit and, being permanently attached, need not be removed when the wire connections are made to the switch binding posts. It is thus impossible for plaster, mortar or grit to fall inside the porcelain cup, endangering the operation of the switch mechanism. The switch has been approved by the Underwriters' Laboratories. The binding post, with its L-shaped base and head, is set snugly into a recess in the wall and into the reinforced bottom of the porcelain cup. Here it is held rigidly in place by two screws passing through the porcelain base, so that the post cannot be thrown out of alignment when tightening the binding screw. The push mechanism is supported top and bottom. Below it is fastened with two screws through the base of the cup, and above it is held firmly in position by the cross-bar, which is in turn attached to the porcelain base by two screws.

The operating mechanism is made of hardened and tempered steel. The spring contact parts are of phosphor bronze and of ample cross-section. Edges and corners of the porcelain base or cup are smoothly rounded, rendering them much less susceptible to breakage than when left rough or unfinished. The heavy, easily accessible binding screw, with its large, strong head, makes the switch easy to wire, and ample pressure is secured on the connecting wire without stripping the threads.

By an ingenious method the upper part of the binding post, where the binding screw enters, is punched to form a collar. This adds to the number of threads through which the screw shank passes and doubles the amount of compression which can ordinarily be brought to bear on the point of contact under the screw head.

The buttons project the least possible distance through the plate, making it a truly flush switch. Temporary plates are not required when these switches are installed, as only the push-buttons and binding-screw heads are exposed. The fiber cover protects the mechanism of the switch. An improved cam construction gives the switch mechanism an extremely quick make and break. Shallow construction of the cross-bar allows a stamped faceplate, with reinforced screw holes, to rest firmly on it, so that buckling of plates is an impossibility.

The lock switch (Fig. 2) is similar in construction, except that the locking attachment is substituted for the push-button. It can be operated only by the proper key, irrespective of whether the faceplate is attached or not. The switches are shallow and are made to fit any standard wall box.

Device for Making Ground Connection

The accompanying illustration shows a type of ground connection which is now being manufactured by the L. S. Brach Supply Company of New York City. It is claimed that this device will produce a low-resistance contact between the ground wire and the earth itself which it is impossible to secure through the ground wire or plate in common use. To accomplish this the ground connection has been designed to retain the moisture in the vicinity of the contact, to present a sufficiently large area of metal surface to the earth, and to insure firm contact between the earth and the metal plates. To secure moist earth three bowls or cups are fastened to a center ground rod, providing a means for rain water as it seeps through the earth to be caught and retained within the grounding device itself. This water will remain in bowls as long as the surrounding earth is moist. When, by reason of the hot sun, evaporation takes place and the earth becomes dry, there still remains a local moist area due to the water that will be given off from the bowls. To aid in attracting and holding water, small pieces of charcoal are placed within the bowls and covered by a perforated metal screen. The perforated screen itself is intended to protect the space in the bowls from being displaced by the surrounding earth, so that ample water space may be retained. The three bowls being sweated to the center rod offer more than three times the exposed surface which the common ground plate can offer for a hole of given size. The third essential, that of securing firm contact with the earth, is provided for by reinforcing the bowls and the metal screw so that the earth may be packed tightly around the ground connection.

DEVICE FOR MAKING GROUND CONNECTION

At the top of the center rod a slot milled in a threaded portion affords a convenient means of joining the ground wire to the earth connection. These hydro-grounds, as they are called, are now being manufactured in three standard sizes, each size carrying three bowls of varying diameters.

The Cooper Hewitt Quartz-Tube Mercury-Vapor Lamp

By Joseph C. Pole.

The quartz-tube mercury-vapor lamp represents an additional commercial development of the principles involved in the vapor lamp invented by Dr. Peter Cooper Hewitt. In principle the difference lies only in the greatly increased pressure of the luminous vapor. The standard Cooper Hewitt lamp is operated at a pressure equal to about ⅛ in. mercury column, while the pressure in an operating quartz lamp may be that of the atmosphere or higher. The result is that the temperature of the luminous vapor is extremely high, necessitating a potential per inch of the luminous

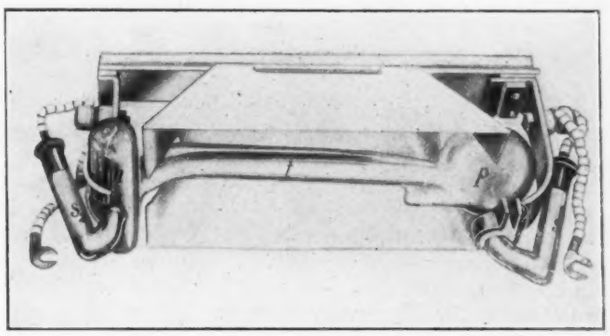


FIG. 1—QUARTZ BURNER

column which is very great and the use of a correspondingly short tube. In spite of having been built upon the same physical foundations, these two types represent, from the practical point of view, a decided contrast. One possesses great area of luminous surface with a consequent small intrinsic brilliancy and so low a temperature that it may be considered near the "cold light" of the scientist; the other has a radiant of small surface giving a very concentrated and intense light and operating at high internal temperatures. In addition to the discontinuous spectrum characteristic of mercury, the quartz lamp emits a luminous spectrum, and it is due to this circumstance that its light contains, besides the predominant yellow, green, blue and violet lines of the mercury spectrum, the red and orange

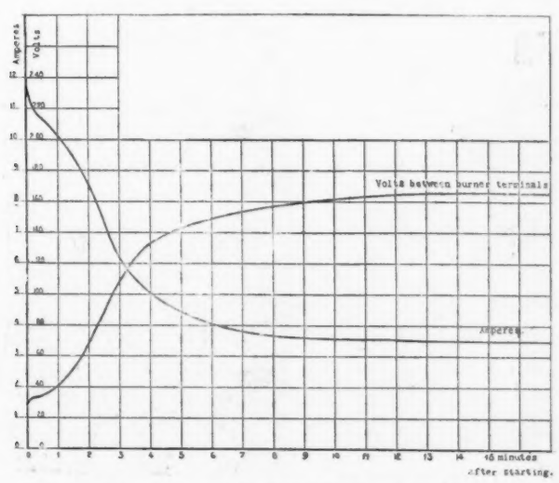


FIG. 2—STARTING CHARACTERISTICS OF QUARTZ LAMP

rays. The latter at the higher vapor temperatures are much more numerous.

A vacuum container for the direct-current quartz lamp is shown in Fig. 1. The tube *t* carries the luminous vapor and terminates at the positive end in an enlargement *p* and at the negative end in the lateral tube *n*. Mercury in each enlargement forms the two electrodes, which receive the electric energy through small upright U-tubes s_1 and s_2. Rods of a special alloy slightly conical in shape are ground into the wall of these upright tubes, and the joints are covered with mercury, which again is closed in by a layer of a suitable compound. This prevents the access of air and serves the purpose of keeping the mercury from being spilled or vaporized.

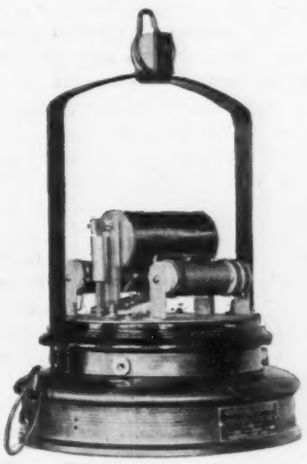


FIG. 3—OPERATING MECHANISM FOR 110-VOLT, 4-AMP LAMP

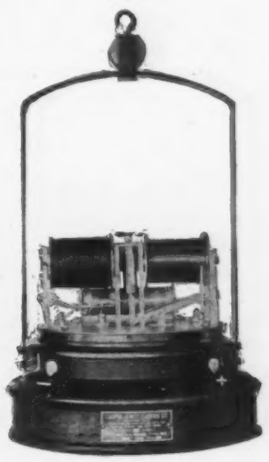


FIG. 4—OPERATING MECHANISM FOR 220-VOLT, 3.5-AMP LAMP

When a cold quartz lamp is started it requires a rather high current owing to the small drop of potential at the low pressure, and the whole cross-section of the luminous tubes of the burner is filled with the pale bluish-green light. But presently, as the lamp warms up, the appearance changes. The light recedes from the walls and, with increasing vapor pressure, becomes concentrated in the center of the tube in a thin dazzling path. The current value drops steadily at first, then becomes constant, and the appearance of the light assumes a whiter color with a visible gain of red and orange rays as the lamp attains its temperature of operation. The change in the lamp current

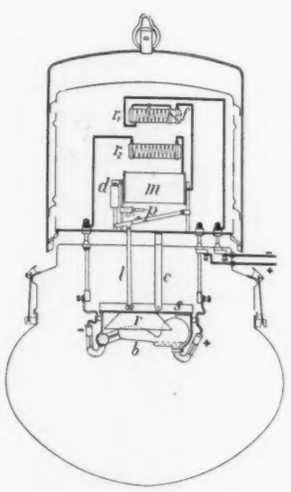


FIG. 5—DIAGRAM OF 110-VOLT, 4-AMP LAMP

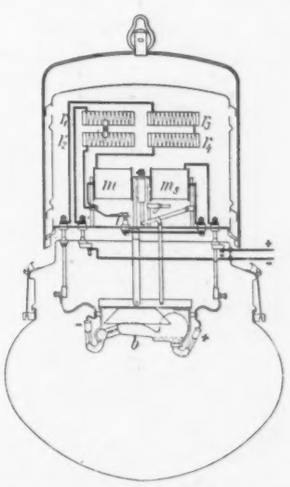


FIG. 6—DIAGRAM OF 220-VOLT, 3.5-AMP LAMP

and the voltage of a 220-volt, 3.5-amp lamp with reference to time after starting is shown in Fig. 2. The essential parts of a commercial quartz-lamp outfit are a series resistor for regulating the burner potential and making the lamp adaptable to a wider range of supply voltage, a series inductor for steadying the arc, a glass globe to prevent too rapid a dissipation of heat from the burner and to absorb

the ultra-violet rays, and, if the lamp is to be automatic, a starting device.

The ultra-violet rays, in which the mercury arc is especially rich and which are readily transmitted by quartz, may be considered injurious to the eyes at close range. The most actinic of these rays—that is, those with the shortest wave length—are absorbed by passing through a few inches of air, and all are completely absorbed in common glass, so that a surrounding globe of clear glass affords protection from these rays. When a quartz lamp is used for the purpose of the generation and utilization of ultra-violet rays, no glass should be inserted in the path and the lamp should be placed as close as possible to the exposed object.

The two types of quartz lamps which are to be described are for multiple connection on direct-current lines of 110 volts and 220 volts. From alternating-current supply circuits they may be operated through the medium of a rectifier. The 110-volt, 4-amp quartz lamp is shown in Figs. 3 and 5. The burner is securely held in an aluminum support *s*, to which a white enameled reflector *r* is fastened. The holder with its T-shaped backbone is pivoted in a support *c* and by means of the tilting lever *l* is linked to the movable iron armature of an electromagnet *m*. In order to avoid sudden shocks to the movable parts, a dashpot *d* is connected to the armature. A small movable permanent magnet *p* is shown suspended above the armature. This magnet automatically locks the tilting device when the polarity at the lamp terminals is reversed and so protects the burner against being ruined by a reversal of polarity. Two small resistance coils, r_1 and r_2, which are equipped with a fuse wire *f* and a sliding contact for regulation, complete the auxiliary apparatus. The ventilated canopy, the insulated hanger and the ring holding the glass globe are very similar to those used with arc lamps.

The burner, magnet and resistor are all connected in series. The burner in its position of rest is so inclined that the two mercury electrodes are in contact. When the line switch is turned on the short-circuit current magnetizes the solenoid *m*. This actuates the movable armature, and through it the burners are turned on their pivots until the contact between the two mercury electrodes is broken and the arc started. As long as energy is supplied to the lamp the burner is held in its running position by the magnet. The fuse wire *f* will withstand the heavy current during the starting period, but will within one minute be fused by the additional heat generated in the resistance spool r_1, if for any reason the mechanism should stick and the short-circuited burner continue to receive energy.

The 220-volt, 3.5-amp lamp shown in Figs. 4, 6 and 7 has a similar burner and is in general appearance much like the lamp described above, but its mechanism is different. The operating position of the quartz burner *C* (Fig. 5) is identical with its position of rest. For starting the two electrodes are brought in contact by the movable armature of a shunt magnet m_s. At the moment of the short-circuit between the electrodes the series induction coil *m*, operating an automatic cut-out *i*, is energized and interrupts the circuit of the shunt magnet, so that the burner drops back to its original position and the arc is started. This auxiliary is also provided with an automatic locking device for protection against reverse of polarity. Four series resistance coils, r_1, r_2, r_3 and r_4, the first two of which are equipped with the sliding contacts, complete the mechanism.

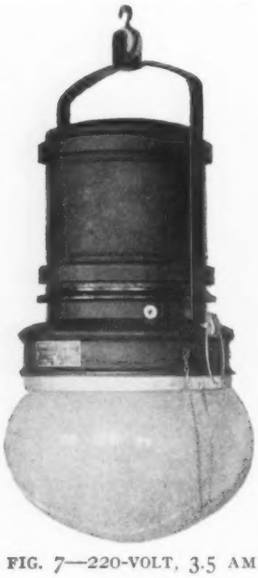


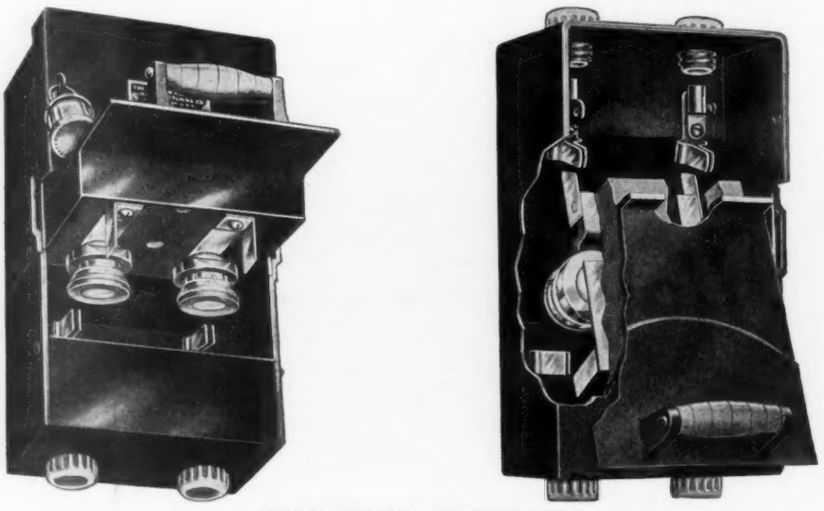
FIG. 7—220-VOLT, 3.5 AMP LAMP

Service Switch and Fuse Box

The accompanying illustrations show a type of switch and fuse box which the Palmer Electric & Manufacturing Company has placed on the market. The box has been designed particularly for use as a sealable service cut-out for the control of low-potential circuits but may be used for any purpose to which a switch and fuse may be applied. When the box is opened for inspection or in order to replace a fuse all exposed parts may be handled at will. The fuses and the parts upon which they are mounted do not become a part of the circuit until the box is tightly closed.

The illustration shows the box with the switch in an open position, the fuses being exposed for inspection or replacement. A simple lock which is operated by the action of opening and closing the box holds the switch and fuse-carrying members in the position indicated so that they do not have to be held open by hand while the fuses are being replaced. As the service wires are connected to the terminals at the upper end of the box, which is sealed, it is apparent that all of the parts of the box that normally carry current are dead when the switch is open, and in consequence the live parts of the switch are not accessible without breaking the seal.

The box may be mounted with the service chamber at either the top or the bottom without change in any of its arrangements to comply with the National Code requirements relative to the fuse protecting the switch. The fact that the fuse contacts are dead when the box is open, it is claimed, will greatly lessen the possibility of accident to the operator such as might otherwise result from flashes and short-circuits.



SERVICE SWITCH AND FUSE BOX

Switch for Remote Control

In order to render it suitable for installation at points where it may not receive a great amount of attention, the remote-control switch shown in Fig. 1 has been substantially constructed and built with few operating parts. The switch is a self-contained unit, carrying laminated copper brushes at the main contacts, which are so constructed that each

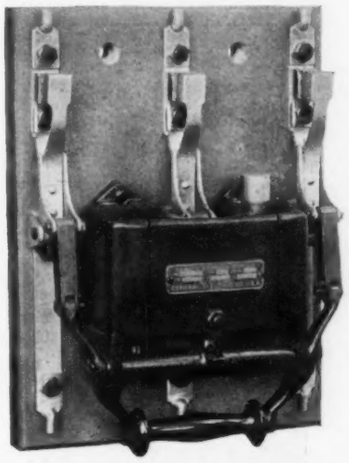


FIG. 1—100-AMP, 250-VOLT ALTERNATING-CURRENT OR DIRECT-CURRENT REMOTE-CONTROL SWITCH

lamination makes end-on contact. On closing, these contacts "wipe in," thus insuring bright surfaces. The auxiliary contact on which the arc breaks are made of carbon blocks.

The switch is operated by a double-coil solenoid which is controlled by a special double push-button switch. The normal position of the latter is the open one, and it remains closed only when held by the operator. To open or close the switch the corresponding push-button is pushed. A push-button switch is furnished with each remote-control switch and must always be used, as the solenoid coils are not designed to conduct their excitation current continuously. The cores of the operating solenoids are connected directly to the operating lever, which in turn is connected to the poles of the switch through a toggle mechanism. When a coil of the solenoid is energized its core moves the operating lever up or down, forcing the switch closed or open, this depending upon which coil is energized. A handle by which the switch may be opened by hand is provided and may be seen at the lower part of the switch in the illustration.

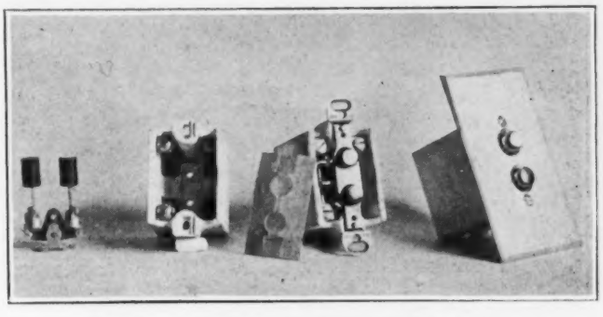


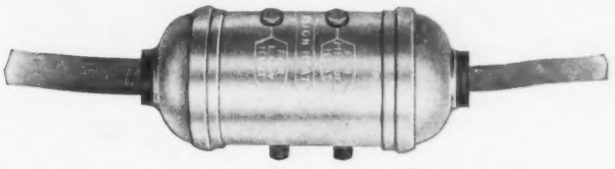
FIG. 2—CARBON-BREAK PUSH-BUTTON SWITCH

The switch is made single, double or triple pole, single throw for service on alternating-current and direct-current circuits for potentials of 110, 125, 220 and 250 volts, and can be furnished up to 300-amp rating. The standard finish of all the live parts of the switch is polished copper, while that of the mechanism is marine. This switch is manufactured by the General Electric Company.

Three-Circuit Cord Switch

There are many electric heating devices now on the market which are designed to operate at several temperatures. It has been found that such devices as electric water urns, chafing dishes, heating pads, frying pans, table stoves, tailors' irons, etc., may be advantageously operated at three different temperatures, namely, low, medium and high. For the convenient control of these devices the Cutler-Hammer Manufacturing Company of Milwaukee has augmented its line of cord switches by the addition of a three-circuit brass-shell type as shown in the accompanying illustration. This switch may be placed on the cord in any convenient location for operation.

There are two push-bars, each having a light and black

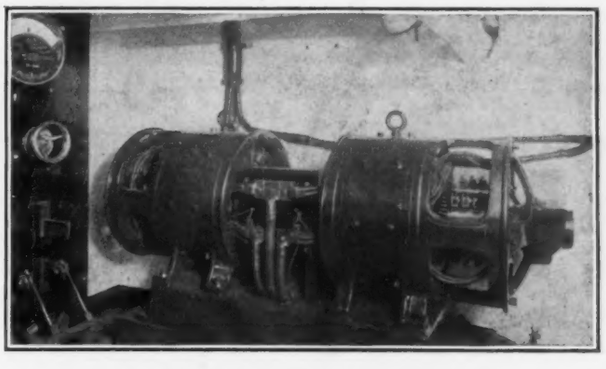


THREE-CIRCUIT SWITCH

button, which operate twin mechanisms so arranged that the pushing of one light button gives low temperature, while the other operated alone gives medium temperature. The shell is marked so that the operator may know which button to press for low and which for medium temperature. To obtain the highest temperature both buttons are pushed. The operation is positive and quick, and one hand only is needed for the manipulation of the push-buttons. As can be seen from the illustration, two-conductor cord is required to connect to the socket or receptacle and three conductor cord is needed to connect the switch to the heating devices. The brass shell is finished in polished nickel. The rating of the new three-circuit switch is 6 amp 125 volts, 3 amp 250 volts.

Balancer Sets for Electric Projector Circuits

It is interesting to note the progress in modern lighting and the different spectacular effects obtained through the use of the large electric search-lanterns. As a notable instance the Singer Tower in New York City, which at night gives the soft touch of carefully planned and concentrated illumination to the twinkle of the thousands of individual lights from the surrounding office buildings, may be cited.



BALANCER SET FOR SINGER BUILDING

The electrical energy from the Singer Building power plant is furnished at 250 volts, direct current. In order to economize in the use of copper for all lighting circuits two 70-kw balancer sets, one of which is illustrated herewith, were installed. One of these sets is idle at all times except when shifting the load from one set to the other. Each set consists of two 35-kw, 125-volt compound-wound, com-

mutating-pole generators, running at 1300 r.p.m. These generators are of special construction, being built with steel frames, laminated pole pieces and wrought-iron commutating-pole pieces. They are light in weight and operate noiselessly, giving satisfactory commutation up to 25 per cent overload.

The field coils of the two machines are connected in series across the 250-volt mains. The voltage regulation maintained by these sets is so close that one does not notice an appreciable falling off in the illumination, even with the load so unbalanced as to give 580 amp in the neutral wire, which represents a rare condition.

The tower lighting itself is also operated on a three-wire system, and although the amount of unbalanced load is much smaller than that of the office lighting system, the balancing set is of the same size and rating in order that the three sets may be interchangeable. The tower lighting is accomplished by means of 18-in. projectors operating at 35 amp each and showing an average apparent candle-power of approximately 6,000,000. These are supplemented by 30-in. projectors having an approximate apparent candle-power of between 50,000,000 and 60,000,000 each. The balancer sets for this installation were manufactured by the Diehl Manufacturing Company of Elizabethport, N. J.

Double-Arm Exploring Mirror

The accompanying illustration shows a device recently put on the market by the Leeds & Northrup Company, Philadelphia, Pa., for use in photometering arc lamps and other large illuminating units. Two large mirrors, each 18 in. by 22 in., are so arranged that the light rays from the lamp under test are reflected from them to the screen of the photometer sight box. The arms supporting these mirrors are counterweighted and mounted on a common axis so that the mirrors may be rotated about a common center to any desired angle, the degree of rotation being measured by a small graduated scale. The height of the center of rotation of the mirrors is adjustable and may be changed to correspond to the height of the photometric axis of any photometer which is employed in measurement. In using the device the mirrors are placed symmetrically about the lamp at equal distances on either side of a vertical axis and the light reflected by them is compared to a standard through any common type of photometer. In this manner the average value of the candle-power in that plane is readily obtained.

DOUBLE-ARM EXPLORING MIRROR

Dry Storage Battery

The Cook Railway Signal Company, Denver, Col., is marketing a dry secondary battery invented by its electrical engineer, Mr. N. Fallek. It is claimed that a complete departure in manufacturing methods has developed a different character of plate, through various combined chemical and electrolytic treatment baths after the first forming processes. The plates as spaced by their head frames are then surrounded with a moist element in lead or rubber jars, no separators being employed, and with terminals added and a compound filler provided at the top, the unit is ready for use. Among the particular advantages claimed for the battery are freedom from spilling of electrolyte, evaporation or warping. The latter condition is attributed to the mechanical construction employed as well as to the protection afforded by the element action against sulphating. Compactness of construction is said to be characteristic of the battery, and this is claimed to reduce the internal resistance and to limit the injury by heating. The recuperative powers and plate life, according to the manufacturer, are unusually good. It is said that batteries of the type described have been employed successfully in aeroplane work. Tests and comparative data on weights, resistances and performance curves are not available for publication at this writing; but the manufacturer states that after exhaustive tests have been finished information of this character will be compiled and given to the trade.

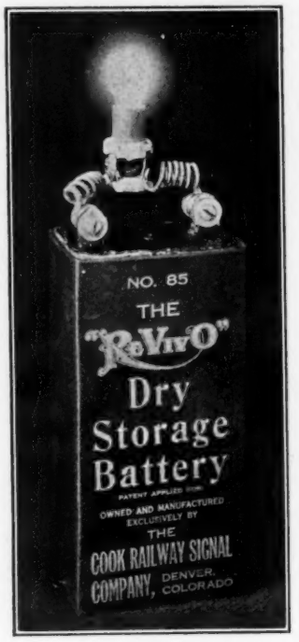


FIG. 1—2-VOLT, 20-AMP-HOUR CELL

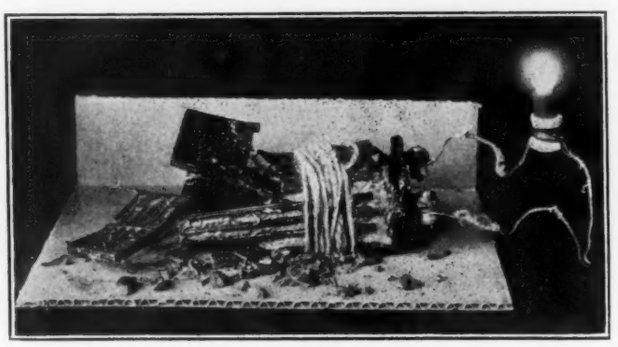


FIG. 2—BROKEN PARTS OF CELL HELD WITH ROPE STILL ACTIVE

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Annual Report of Allgemeine Elektricitäts-Gesellschaft.—The magnitude of the operations of the Allgemeine Elektricitäts-Gesellschaft, of Berlin, in 1912 greatly exceeded the expectations the company had entertained for that year. Much of the increase in orders received is ascribed by the company to the extension of its organization to all parts of the civilized world and to the larger demand for electrical equipment resulting from the rapidly broadening application of central-station service in large industrial territories. In order to meet the heavy demands for equipment the company found it necessary during the year to make extensive additions to its manufacturing facilities. The company has issued 4½ per cent debentures to the amount of about $6,000,000, and proposes to increase its original capital by issuing new shares with a nominal value of $5,000,000. A dividend of 14 per cent was declared as a result of the year's operations. Inasmuch as deliveries at the Brunnenstrasse factories fell behind the orders received, there is now ample work on hand to keep the facilities of the additional factory buildings to be erected in the next few months fully occupied for a considerable time to come. During the year the output of machines and transformers from the Berlin factory increased from 2,385,869 hp in the preceding year to 2,529,000 hp. The machinery constructed include three-phase generator units, with outputs up to 15,000 hp for hydroelectric plants, generators up to 4500 kw for connection to gas and Diesel engines and numerous rolling-mill drivers, particularly for reversing rolls. A new development during the year was the electrical equipment of submarine boats with special motors and switchgear. A number of single-phase locomotives with necessary controlling apparatus were also constructed. Transformers up to 15,000 kw at voltages ranging as high as 110,000 were built in large numbers by the company and improvement in the design of oil switches for heavy outputs also became necessary through the increasing size of central stations. A new line of direct-current motors from which the company expects much success was developed during the year. The prices obtained by the turbine factory showed a slight improvement over those in 1911. The output in steam turbines in 1912 aggregated 735,648 hp, as compared with 441,467 hp in the preceding year. Much progress was made in the development of high speed, three-phase units. The largest turbine unit constructed was of 20,000 kva rated output. Two units rated at 18,000 kva and one at 12,500 kva were also constructed. The output of the arc-lamp and clock factory was practically the same as in the preceding year. Flaming arc lamps, the report says, are rapidly increasing in favor and are having a steadily increasing demand, notwithstanding the competition offered by high candle-power metallic filament lamps. The company states that the quartz-mercury lamp manufactured in Hanau with the co-operation of the Allgemeine Elektricitäts-Gesellschaft has increased appreciably in importance. A large increase was also made in the manufacture of switches, heavy installation material, meters, fans and electromagnetic instruments. The possibilities of the electric-heating field have been realized more fully by the company than in the past, and special attention was given during the year to the manufacture of electric heating and cooking apparatus for domestic and industrial purposes. The company's output of this class of equipment increased more than 75 per cent in 1912 over that in 1911. Insulators for potentials as high as 100,000 volts were made in the porcelain factory during the year. A large number of experiments with a view to introducing ozone into various branches of industry were conducted at the Frankfort factory. All departments of the Oberspree cable works were so busy, as was the case in 1911, that the orders were made possible of execution only through the employment of two and three shifts. The prices for insulated wire remained at a low point during the year, although some improvement was made over the quotations of 1911. The use of enameled wire as a substitute for cotton-covered and silk-covered wire showed marked increase. The heat-resisting and insulating properties of the company's special insulating material, tenacite, were further improved during the year. An appreciable reduction was made in the cost of manufacturing drawn filaments as well as a decided increase in their breaking strength. The output of carbon filament lamps has naturally shown a material decrease under prevailing conditions. The number of employees in the company's vehicle branch increased to more than 2000, and the output showed a gain of 50 per cent over that in 1911. Including work done in 1912, the company had installed motor-drive equipment for 385 rolling mills by the end of that year. The volume of business in mining equipment reached large proportions, and the volume of electrically operated hoists and elevators manufactured was the highest on record. Equipment for street railway systems continued to have a large demand during the year. The company had 70,162 employees on its pay rolls at the end of its fiscal year.

Detroit Insulated Wire Employees Shared 1912 Profits.—Following the custom which it inaugurated some years ago, the Detroit Insulated Wire Company, of Detroit, Mich., distributed a generous percentage of its 1912 profits among its employees. The amount which each received was based upon the length, continuity and value of his or her service. Hourly rate employees who had been with the company one year or more received, in accordance with the practice in preceding years, 2 per cent of their total wages since entering the continuous employment of the company. On this basis, for example, an employee with a record of five years of steady employment received 10 per cent of the average yearly wage. All monthly rate employees who had been with the company one year or more received 1 per cent of all salaries earned since entering continuous employment with the company. In announcing the bonus to the employees the company said in part: "We are presenting this to you because we believe it pays to reward faithful and steady workers so long as results and earnings make it possible. We hope that our combined efforts may continue to yield results that will permit this distribution for many years. As heretofore, the rule is that any employee discharged for cause or who has left for any reason (other than sickness, leave of absence or temporary lay-off), even though re-entering our employ after a short time, loses credit for previous employment and will receive this bonus based only on the time of continuous employment since re-entering our employ. Our business is highly competitive and the profits per dollar of business are very small. To earn any money we are all obliged to work hard and steadily. This cannot be accomplished with employees coming and going, therefore we are aiming to induce our employees to remain with us steadily." The company does not guarantee to the employees, however, continuation of similar distributions from year to year.

Crocker-Wheeler President Discusses Growth of the Electrical Trade.—Dr. Schuyler Skaats Wheeler, president of the Crocker-Wheeler Company, said recently of the electrical manufacturing business in 1912: "The volume of business in electrical machinery this year will closely approach $300,000,000. This is a moderate estimate because it embraces an increase of only 20 per cent, the total in 1909, according to the latest census report, having been $243,000,000. The business of one company I know of has increased by a far greater percentage not only in volume but in variety. I am glad to say that with the spread of better knowledge

of electricity has come a demand for higher standards in apparatus and much more severe acceptance tests than formerly. In years gone by we have had machines 'inspected' and accepted by men who were as innocent of all knowledge of electrical machinery as a baby is of the uses of radium. Proof of the more general and discriminating interest in electrical machinery is found in the greater variety of machinery which is required. Our business in large alternating-current machinery, turbo-generators and transformers now rivals our output of direct-current machinery. As I have pointed out before, the volume of the electrical business in this country is an excellent index of the total volume of business. Practically all manufacturing plants have adopted electric drive for their machine tools."

Turbine Equipment for Steel Mills.—The Carnegie Steel Company has placed an order with the General Electric Company for two turbine units, one of which, a 5475-kva high-pressure condensing unit, will be installed at the Edgar Thompson works at Braddock, Pa., and the other, a 3750-kva mixed-pressure unit, is for the Homestead works at Munhall, Pa. In connection with the smaller unit, the Carnegie company has placed an order with the Rateau Steam Regenerator Company, 90 West Street, New York, for two regenerators which will receive the intermittent exhaust from several mill engines in the plate mill, varying from practically zero to a maximum of 300,000 lb. per hour, and will deliver a constant flow at the rate of 130,000 lb. per hour to the turbine. The latter will be equipped with a Rateau mixed-pressure governor. Both turbines will drive alternators which are to deliver three-phase, 25-cycle energy at 6600 volts. The Inland Steel Company, at Indiana Harbor, Ind., has placed an order for two Rateau regenerators, which will receive the exhaust from the engines in a blooming-mill and a bar-mill, with a maximum discharge of 485,000 lb. per hour and deliver a constant flow at the rate of 155,000 lb. per hour to two low-pressure turbines, each rated at 2000 kw. These will drive alternators.

Cedar Rapids Manufacturing & Power Company's Refunding Plan.—Stockholders of the Cedar Rapids Manufacturing & Power Company, of Montreal, were scheduled to hold a special meeting on Jan. 3 to vote upon a proposition to redeem any part of an authorized issue of $10,000,000 bonds and also to issue new bonds to the amount of $15,000,000. In November last the directors of the company received authority to increase its capital from $10,000,000 to $15,000,000 and the meeting was for the purpose of considering what form the increase should take. The present capitalization of the company consists of $10,000,000 authorized stock, of which $8,000,000 is outstanding, and $1,500,000 first-mortgage forty-year sinking-fund 5 per cent gold bonds due Jan. 1, 1952. This is a part of an authorized issue of $10,000,000, of which $5,000,000, including the $1,500,000 now outstanding, are issuable forthwith. The balance is reserved for constructions or acquisitions, improvements, etc.

Alabama Traction, Light & Power Company Orders Equipment.—Contracts for power-station equipment amounting to approximately $300,000 have been placed with the Westinghouse Electric & Manufacturing Company by the Alabama Traction, Light & Power Company, which, as previously noted in these columns, controls important water-power rights in the State of Alabama capable of developing several hundred thousand horse-power. The order just placed is for the initial equipment of the company's plant at Lock 12 on the Coosa River. It calls for four 13,500-kva, 6600-volt, 60-cycle, three-phase, vertical-type generators for operation at 100 r.p.m. With each is a direct-connected exciter. In addition to this equipment the contract includes twenty 4500-kva, single-phase, 6600-volt to 110,000-volt transformers.

Arkansas Hydroelectric Plans.—Control of the Garland Power & Development Company, which controls water-power sites on the Ouachita River, about 45 miles from Little Rock, has been acquired by interests associated with the Little Rock (Ark.) Railway & Electric Company. New officers have been chosen for the Garland company as follows: President, C. C. Kavanaugh; vice-president and treasurer, W. M. Kavanaugh, and secretary, D. H. Cantrell, all of Little Rock. The Garland company has been considering the construction of hydroelectric developments with an aggregate rating of 28,000 hp on the Ouachita River. The plan provides for distribution of energy within a 100-mile radius of Little Rock, from the first station, to rice planters in the neighboring counties.

William P. Bonbright & Company Reincorporate.—William P. Bonbright & Company, 14 Wall Street, New York, investment bankers and dealers in public-utility securities, have filed articles of incorporation under the name of William P. Bonbright & Company, Inc. The capital of the new company will be $5,500,000 in 7 per cent preferred stock and 100,000 shares of common stock without par value. The object of the incorporation is to provide capital for the rapidly growing business. The partners are: William P. Bonbright, Irving W. Bonbright, William F. Fisher, Frederic C. Walcott, Starling W. Childs, Frederick W. Stehr, George R. Buckman, the Right Hon. Albert Lord Fairfax, Orlando B. Willcox and A. C. Cassells.

Hartford (Conn.) Electric Light Increases Its Capital.—Directors of the Hartford (Conn.) Electric Light Company have voted to recommend to the stockholders an increase in the outstanding stock from $3,000,000 to $3,600,000. The authorized issue is $5,000,000. Stockholders are to meet on Jan. 8 to vote upon the proposition, and if it is approved, they will obtain the right to subscribe for the new stock at the rate of one share of the new for each five shares of the old, payable in two instalments, one on Feb. 4 and the other on Aug. 5. The employees were given a dividend of 5 per cent on their annual salaries on Jan. 1.

New Utility Company for Cincinnati.—While no details have been made public it is understood that a new central-station company has been formed to compete with the Columbia Gas & Electric Company, which operates in Cincinnati. It is said that interests which were affiliated with the latter prior to its acquisition in July last by a syndicate headed by A. B. Leach & Company, of New York, are behind the new project and that the installation of the block-plant system will be promoted.

Progress of Toledo Railways & Light Reorganization.—The reorganization committee of the Toledo Railways & Light Company has announced that holders of over 75 per cent of the outstanding stock of the company have assented to the proposed plan for reorganization. More than 60 per cent of the holders of outstanding stock have paid the assessment of $7.50 a share. The time for deposit of the stock has been extended to Jan. 4, 1913.

Evansville (Ind.) Company Files Mortgage.—The Evansville Public Utilities Company, which, as previously noted, is a consolidation of the Evansville Public Service Company, the Evansville Gas & Electric Light Company and the Evansville & Southern Indiana Traction Company, has filed a mortgage for $10,000,000. The proceeds will be used to retire the securities of the old companies.

Northern California Power Closes Large Contract.—A contract has recently been made between the Northern California Power Company and the Oro Electric Corporation through which about 20,000 hp in electrical energy will be furnished to the Oro company. The latter will purchase this energy until the hydroelectric station which it is building on Yellow Creek is completed.

Foreign Orders for Searchlights.—The Carlisle & Finch Company, of Cincinnati, has just made a shipment of seventeen cases of searchlights to fill an export order from one foreign customer. The Greek torpedo boats that have comprised the naval arm of the Balkan allies were recently equipped with searchlights made by this company.

To Operate in Venezuela.—The Venezuela Electric Light Company has been organized under the laws of Ontario with a capitalization of $1,500,000 to do an electric-service business in Venezuela. The company is a MacKenzie-Mann project and will utilize undeveloped water-power resources in the South American republic.

Alaska Hydroelectric Plant Nearly Completed.—The 5000-kw hydroelectric power station which is being built for the Alaska Gold Mining Company will be placed in operation very shortly. It is understood that the company will begin the construction of a 160-ft. dam next spring.

Birmingham (Ala.) Railway & Light Financing.—Stockholders of the Birmingham Railway & Light Company have authorized the issuance of $400,000 of common stock. This

is to be subscribed for at par and payable in cash. The proceeds will be used for repairs to the traction properties.

National Carbon's Earnings.—Net earnings of the National Carbon Company for its fiscal year ended Dec. 31, 1912, were, it is understood, equal to the record results of 1910, when a balance of $1,303,000 was shown for the stock.

United Illuminating Company (Conn.) Plans Stock Increase.—Stockholders of the United Illuminating Company, of New Haven, Conn., are to vote on Jan. 4 on increasing the authorized capital stock from $2,000,000 to $2,500,000.

NEW YORK METAL MARKET PRICES

	Dec. 23 Bid.	Dec. 23 Asked.	Dec. 30 Bid.	Dec. 30 Asked.
Copper:				
Standard, spot	17.00	17.37½	17.00	17.37½
	£ s d		£ s d	
London, standard, spot	75 15 0		76 5 0	
Prime Lake	17.60 to 17.65		17.65 to 17.75	
Electrolytic	17.50 to 17.55		17.55 to 17.65	
Casting	17.35 to 17.40		17.35 to 17.45	
Copper wire, base	19.00		19.00	
Lead	4.35		4.35	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.35		7.35	
Tin, spot	50.25		50.62½	
Aluminum:				
Prompt delivery	26.25 to 26.50		26.00 to 26.50	
Future	26.50 to 26.37½		25.75 to 26.25	

OLD METALS

Heavy copper and wire	16.00	16.00
Brass, heavy	10.00	10.00
Brass, light	8.50	8.50
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	6.12½

COPPER EXPORTS IN DECEMBER

Total tons to	Dec. 24, 18,834	Dec. 31, 27,228

INDUSTRIAL SECURITIES

Security.	Capital Stock Listed.	Dividend. Per Cent.	Dividend. Period.	Quotation. Dec. 24	Quotation. Dec. 31
Allis-Chalmers, 2d assess. paid	$17,151,100	.....	.....	1¼*	1¼
Allis-Chalmers, pf., 2d assess. paid	14,034,700	.....	.....	4⅞*	5
Amalgamated Copper	153,887,900	1	Q	75⅛	78⅛
American Tel. & Tel.	334,712,300	2	Q	140	139½
Electric Storage Battery, c.	16,074,425	.....	.....	53½	53½*
General Electric	77,726,700	2	Q	183½	186
Mackay Cos., c.	41,380,400	1¼	Q	8 *	8 *
Mackay Cos., pf.	50,000,000	1	Q	66¾*	66¾*
Western Union Tel.	79,943,400	¾	Q	75½	75½*
Westinghouse E. & M., c.	31,685,300	1	Q	7 ½	79½*
Westinghouse E. & M., pf.	3,998,700	1¾	Q	121½	121½*

*Last price quoted.

Personal

Mr. John T. Whistler, formerly of the Reclamation Service, gave a talk on "Some of Our Water Resources" at a recent meeting of the Oregon Society of Engineers.

Mr. Weare Parsons has been elected treasurer and general manager of the Springfield (Ohio) Light, Heat & Power Company, the reorganization of which was effected recently.

Mr. H. C. Barber, who was assistant chief engineer of the municipal hydroelectric system in Hamilton, Ont., has been appointed assistant manager of the Toronto Hydro-Electric System.

Mr. J. H. Doherty has resigned as contract agent of the Corning (N. Y.) Gas & Electric Company to become general manager of the Fulton (N. Y.) Light, Heat & Power Company.

Mr. Clifton R. Hayes, local manager of the Fitchburg (Mass.) Gas & Electric Light Company, has been elected president of the Fitchburg Board of Trade and Merchants' Association.

Mr. J. Shields, chief inspector of the Jackson City lines of the Michigan United Traction Company, has accepted the position of superintendent of the Manistee (Mich.) Light & Traction Company.

Mr. W. R. Thompson, formerly assistant chief engineer of H. M. Byllesby & Company, of Chicago, has been promoted to be manager of engineering and construction for the same organization.

Mr. Lamar Lyndon, consulting electrical engineer of New York and Atlanta, sailed for Europe recently to join his family at Brussels, Belgium. They will return to New York together about Jan. 15.

Mr. George H. Morse has been appointed consulting engineer of the Mutual Electric & Machine Company of Wheeling, W. Va. Mr. Morse was formerly professor of electrical engineering of the University of Nebraska.

Mr. Joseph D. Evans, who has been chief engineer of the Montreal (Que.) Tramways since June, 1911, severed his connection with that company on Jan. 1 to become construction manager of the Electric Bond & Share Company, New York City.

Mr. John J. Swan, formerly associated with the Chicago Pneumatic Tool Company, New York, as manager of the New York office and later as mechanical engineer in the compressor department, has become associated with the Oil Power Engineering Corporation, New York.

Mr. Hugh T. Wreaks, who for the past year has been acting as special agent on wires and cables for the Underwriters' Laboratories in Chicago, tendered his resignation, effective Jan. 1, in order to devote his entire time to the work of the Wire Inspection Bureau, of which he is secretary.

Mr. William Dieterle has resigned as motor-service contract agent of the Southern California Edison Company to join the organization of a large mining company. Mr. Dieterle has served the Los Angeles company as accountant, traveling auditor, motor-service development auditor, etc.

Mr. L. H. Conklin, past-president of the Pennsylvania Electric Association and secretary of the Warren (Pa.) Light & Power Company, has accepted an appointment as secretary of the transmission section of the National Electric Light Association. Mr. Conklin's headquarters are at Scranton, Pa.

Mr. M. F. Dugan has resigned his position with the Cumberland County Power & Light Company to accept a similar position with the Central Maine Power Company at Waterville, Me. Mr. Dugan was presented with a purse of money at a farewell banquet at the Falmouth Hotel, Portland, on Dec. 21.

Prof. C. Francis Harding, of the school of electrical engineering, Purdue University, Lafayette, Ind., has returned from Madison, Wis., where he was called for a conference with the engineering department of the State Railroad Commission in connection with the Milwaukee street-lighting investigation on which he was engaged during the past summer.

Mr. W. R. Lloyd, secretary of the State Tax Commission of Alabama, has resigned his position and has become associated with the Alabama Interstate Power Company, a corporation supported by English capital which has a number of hydroelectric developments under way on the Coosa and Tallapoosa Rivers in Alabama about 40 miles from the city of Montgomery.

Mr. James Bennett, superintendent of the electrical department of the Canadian Fire Underwriters' Association of Montreal and the only Canadian member of the electrical committee of the National Fire Protection Association, has tendered his resignation, effective April 1, 1913, to accept the appointment of managing director of the Fire Prevention Company of Canada.

Mr. James A. Fleet, general superintendent of the Cumberland County Power & Light Company of Portland, Maine, was the recipient of a farewell banquet on Dec. 21, when he was presented with a leather traveling bag. As announced in the Dec. 7 issue, Mr. Fleet has resigned his position with the Cumberland company and will engage in similar work in the West.

Construction

SAFFORD, ARIZ.—Preliminary steps have been taken by the Farmers' Association of Safford toward the installation of a central electric power station in Safford and the erection of transmission lines to irrigating pumping plants that are to the installed upon a large irrigation district that is to be formed near Safford.

ATKINS, ARK.—The Atkins Lumber Co. contemplates the installation of an electric-light plant to supply electricity for lighting the town.

CABOT, ARK.—W. M. Hudson is promoting the construction of light and water plants in Cabot.

KENSETT, ARK.—A proposition has been submitted to the City Council by U. S. Bratton, of Little Rock, representing a company which proposes to build a dam on the Red River near Heber Springs and install a plant to supply electricity to all towns in this section. Mr. Bratton asked for a 25-year franchise and guaranteed to have power here within 18 months.

McGEHEE, ARK.—The Commissioners of the Water and Light Improvement District of the incorporated town of McGehee have awarded the general contract for construction of an electric-light plant and water-works system for the town of McGehee to T. C. Brooks & Sons, of Jackson, Mich., at $23,638.

ALAMEDA, CAL.—Extensive improvements are contemplated to the municipal electric-light plant within the next six months which will include the purchase of two 300-hp water-tube boilers, one 1250-kva steam turbo-generator, two surface condensers, a 2000-hp closed heater, oil and feed pumps, feeder regulators (3000 kw) and an entire new switchboard with instruments; also the reconstruction of all feeder circuits. Joseph B. Kahn is superintendent.

BANNING, CAL.—The Southern California Edison Co. has been granted a franchise to furnish electricity for lighting the proposed Banning city limits. The plans provide for the erection of the electric system between Redlands and Banning during the next 90 days and will be extended to Coachella before spring.

COPPEROPOLIS, CAL.—The Calveras Copper Co. is planning to build an electric railroad connecting its mines in Copperopolis with a railroad leading into Stockton. The proposed road will be about 16 miles long and will cost about $200,000. J. H. Trerise is superintendent of the company.

COURTLAND, CAL.—The Great Western Pwr. Co. has run a cable across the steamboat slough from Grand Island to Suter Island, and will erect a pole transmission line, 11 miles long, for distribution purposes. The line will be extended on to Ryer Island.

DIXON, CAL.—The Pacific Gas & El. Co., of San Francisco, is reported to have appropriated $60,000 for improvements to its local system. A carload of pole brackets has been received and 30 tons of copper are on the way.

ELSINORE, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, has purchased the plant and holdings of the Elsinore El. Lt. & Pwr. Co. Extensive additions and improvements will be made by the new owners and a 24-hour service established.

LODI, CAL.—The Western States Gas & El. Co. is planning to distribute electricity in and about Lodi. Work will soon begin on installation of the system. W. S. Butler, of Stockton, is general manager.

LOS ANGELES, CAL.—The Angels' Flight Ry. Co. has applied to the State Railroad Commission for permission to issue $100,000 in bonds, the proceeds to be used for extensions, etc.

LOS ANGELES, CAL.—The City Council has authorized the Board of Public Works to advertise for 750 additional arc lamps for lighting the streets of the city. The budget provides for 500 additional arc lamps to be installed during the present fiscal year, but the gas and light committee asked 250 additional.

MODESTO, CAL.—The Modesto & Empire Trac. Co. is planning to install the new Edison's storage battery on the cars operating on its line between Modesto and Empire, a distance of 5 miles. L. L. Bennett is attorney for the company.

MONROVIA, CAL.—The city of Monrovia is planning to extend the municipal street-lighting system in the near future.

PASADENA, CAL.—The city of Pasadena will install two electrically driven centrifugal pumps in the new sewer system on South Grand Avenue. Van Nor Ornum, city engineer, is in charge of the work.

PLACERVILLE, CAL.—Ralph Kyburg contemplates the installation of a 50-kw hydroelectric plant at his summer resort at Riverton, near Placerville. Water from Plum Creek will be utilized to operate the plant.

STOCKTON, CAL.—Plans have been perfected to complete the equipment of the Tidewater & Southern R.R. for electrical operation between Stockton and Modesto by June, 1913. Byron A. Bearce is president.

PUEBLO, COL.—The Arkansas Valley Ry., Lt. & Pwr. Co. will extend its transmission lines through Holbrook Valley, giving the ranchers in the vicinity of Fowler electric light and power service.

CANAAN, CONN.—The Stone & Webster Corpn., of Boston, Mass., has acquired the property of the Berkshire Pwr. Co., of Canaan, which supplies electricity to five towns in this vicinity. The Stone & Webster Corpn. is preparing to build a large plant at Falls Village, a few miles south of Canaan, where it recently bought the water rights owned by the New Haven R. R. Co. The corporation, it is said, will erect a transmission line to Torrington and other manufacturing towns in the Naugatuck Valley.

NAUGATUCK, CONN.—The G. I. R. Glove Co. is installing a new electric plant to supply the factories of the clothing department and druggists' supplies with electricity for lamps and motors. The building is being remodeled to make room for new machinery. The wires will be carried under Maple Street in the new conduit now being laid. When the new arrangements are completed the old boilers and engines will be taken out.

SAYBROOK, CONN.—The Shore Line El. Ry. Co. will apply to the next General Assembly for an amendment to its charter giving it the privilege of supplying electricity for lamps, heaters and motors in the towns through which its railway passes, excepting New Haven.

SEYMOUR, CONN.—The United El. Lt. & Wtr. Co., of Waterbury, has acquired the property of the Seymour El. Lt. Co., which hereafter will be operated as part of the former system. The new owners will make numerous improvements to the local plant, including the establishment of a 24-hour service. Transmission lines will be erected to connect the local system with the Waterbury and Naugatuck system. F. J. Lyon, superintendent of the Naugatuck division, will have charge of the Seymour plant.

DELAWARE CITY, DEL.—The power plant of the American Pwr. Co. in Delaware City was recently destroyed by fire, leaving the city without electrical service.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 21 for furnishing supplies to be delivered at the various navy yards and naval stations as follows: Washington, D. C., Schedule 5087—automobile ambulance; Schedule 5092—1500 ft. double-braided, rubber-covered conductor; 4000 ft. Sherardized steel conduit, miscellaneous electrical supplies and 35,000 ft. weatherproof copper; Schedule 5093—120 chestnut poles, 35 ft. long. Brooklyn, N. Y. Schedule 5097—20,000 lb. granular carbonate sodium. Applications for proposals should give the schedule desired by number.

PALATKA, FLA.—A committee has been appointed by the Board of Trade to make investigations relative to the installation of a municipal electric-light plant. J. H. Yelverton, Jr., W. P. Merriam and A. M. Leach are members of the committee.

CHIPLEY, GA.—Application has been made to the City Council by Messrs. Hall & Gotha for a franchise to construct and operate an electric-light plant in Chipley.

LYONS, GA.—Bonds to the amount of $12,000 have been voted for extensions to municipal water and light systems.

KELLOGG, IDAHO.—The Bunker Hill & Sullivan Min. & Const. Co., Kellogg, expects to purchase within the next six months series arc rectifier system, transformers, lightning arresters, wire, meters, etc.; also heating, cooking and household supplies, etc. Walter C. Clark is superintendent of water and light department.

KELLOGG, IDAHO.—The Long Valley Lt. & Pwr. Co., of Kellogg, expects to erect within the next 18 months about 20 miles of transmission lines and to purchase one 300-kva, 2300-volt, three-phase generator (rope drive), one 500-hp waterwheel and governor, transformers, poles, insulators, lightning arresters, wire and meters; also arc and incandescent lamps and electrical supplies and appliances. Walter C. Clark is president.

SALMON, IDAHO.—The Lemhi Pwr. Co., Ltd., of Salmon, contemplates the construction of a power house and the erection of 12 miles of transmission lines within the next six months; also the purchase of three 56-in. turbines.

EAST MOLINE, ILL.—The City Council has instructed the water and light committee to investigate the cost of maintenance of a municipal lighting plant.

PEKIN, ILL.—The proposed ornamental street-lighting system for Court Street will consist of 90 ornamental lamp-posts, each carrying three-lamp or five-lamp clusters, maintained by underground wires. The cost of the system is estimated at about $11,000. E. L. Conklin, president of the Commercial Club, is interested in the project.

BICKNELL, IND.—The City Council has granted the Bicknell Pub. Utilities Co. an electric-light franchise, under which the company agrees to furnish a 24-hour service. Contracts have been placed for all necessary equipment and apparatus. It is expected to have the plant completed within six months.

CHURUBUSCO, IND.—Frank T. Schultz, superintendent of the municipal electric-light plant in Columbia City, has applied to the City Council for a franchise to establish an electric-light plant in this city.

FORT WAYNE, IND.—The Home Tel. Co. has notified the Secretary of State of an increase of capital stock to the amount of $250,000. The company is planning to make extensions and improvements to its system.

GOSHEN, IND.—The City Council is planning to install a new lighting system on Indiana Avenue, south of Lincoln Avenue, early in the spring.

KENDALLVILLE, IND.—Owing to the announcement that the Bell Tel. Co. would charge a toll between towns in Noble County, the merchants are arranging to organize a new company to erect and equip a new telephone system.

FORT DODGE, IA.—The Fort Dodge Lt. & Pwr. Co. recently installed a 300-hp Babcock & Wilcox Stirling boiler and has just purchased a 25-kw steam-driven General Electric exciter. Richard M. Parker is general manager.

MURRAY, IA.—At a special election held recently the proposition to grant Gilbert Johnson an electric franchise was carried.

NEVADA, IA.—A deal has practically been closed for the sale of the property of the Nevada El. Co. to the Iowa Lt. & Power Co., of Cedar Rapids. William G. Dows is president of the Cedar Rapids company.

SUTHERLAND, IA.—A proposition has been submitted to the Council to install an electric-light system in Sutherland, energy to be supplied from the plant of the Peterson Hydro-Electric Co., of Peterson.

VALLEY JUNCTION, IA.—The City Council is considering the question of establishing a municipal electric-light plant and water-works system. The cost of the proposed plants is estimated at about $40,000.

WINFIELD, IA.—A franchise has been granted Ora Vaught, of Wapello, to install an electric-light plant here.

CLAY CITY, KAN.—The Public Works Commission expects to change the municipal street-lighting system from arc lamps to series incandescent lamps. C. F. Rasmussen is superintendent of the light and plant.

DOWNS, KAN.—The Downs El. Lt. & Pwr. Co. expects to erect within a few months a new power house complete and to purchase one 150-hp steam engine with boiler and all accessories and a 100-kw, two-phase 60-cycle, 2200-volt generator. C. A. Brelsford is manager.

GARDEN CITY, KAN.—At an election held recently the proposition to issue $40,000 in bonds for the installation of a municipal electric-light plant was carried. J. F. Crocker is city clerk.

TURON, KAN.—At an election held recently the proposition to install an electric-light plant and water-works system was carried.

COVINGTON, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 13 for a conduit and wiring system and lighting fixtures in the United States court house and post office at Covington, Ky., in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of the custodian at Covington. Oscar Wenderoth is supervising architect.

EMINENCE, KY.—An ordinance has been introduced in the City Council authorizing the sale of an electric-lighting franchise. The Kentucky Utilities Co., of Louisville, has notified the City Council that it will bid on the franchise and if purchased by it will furnish a 24-hour service. The company also proposes to supply electrical service in New Castle and Pleasureville.

HAZARD, KY.—Arrangements have been made by E. A. Pollard and James Williams, of London, Ky., for the establishment of an electric-light plant in Hazard.

LEITCHFIELD, KY.—The Leitchfield El. Lt. & Pwr. Co. contemplates enlarging its plant and installing water-works equipment, to be operated in connection with its electric-light system.

LOUISVILLE, KY.—The Kentucky Paint & Glass Co., 314 East Market Street, Louisville, it is reported, will be in the market for motors for its paint manufacturing plant.

PADUCAH, KY.—Superintendent J. O. Keebler has submitted a report to the City Council requesting that an appropriation of $1,500 for a generator for the municipal electric-light plant be included in the 1913 apportionment ordinance.

DONALDSONVILLE, LA.—Contracts, aggregating about $41,000, have been awarded by the municipal light and water commission for machinery to be used in remodeling the municipal electric plant to the Diesel Engine Co., the Fort Wayne El. Co. and the Lawrence Machine Co. Plans are being prepared for the new power house and bids for erecting same will soon be called.

LAFAYETTE, LA.—The Louisiana Trac. & Pwr. Co. has purchased a site in Lafayette for its proposed power house for the operation of its electric railways in southwest Louisiana.

BIDDEFORD, MAINE.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 30, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office at Biddeford. Drawings and specifications may be obtained at the above office or from the custodian of site at Biddeford.

BALTIMORE, MD.—The Consol. Gas, El. Lt. & Pwr. Co. will soon establish a new storage and distributing station in the eastern section of the city on Constitution Street, near Monument Street.

BALTIMORE, MD.—The Baltimore International Devel. Co., Munsey Building, Baltimore, it is reported, would like to correspond with manufacturers and contractors relative to the installation of an electric plant at a coal mine in southwest Texas. The company would like prices on boilers, engines, generators and equipment for 200 miles of transmission line, including poles, wires and insulators.

MOUNT AIRY, MD.—George W. Runkles and Emory Wagner are interested in a project to establish electric-light and ice plants and laundry here.

BATTLE CREEK, MICH.—In addition to the Grand Rapids-Kalamazoo line, now under way, the Michigan & Chicago Ry. Co. contemplates building a branch that will connect Battle Creek with Allegan by way of Gull Lake. The other line is from Kalamazoo to Paw Paw, where it branches, one division continuing to Benton Harbor and the other to South Haven.

BAY CITY, MICH.—The Valley Tel. Co. contemplates rebuilding its local system at a cost of from $150,000 to $200,000. These improvements are pending the favorable action of the Council.

BAY CITY, MICH.—The Bay City Pwr. Co. has notified the City Council that it is prepared to submit a proposition to the city to furnish electricity to light the streets of the city and for commercial and residential lighting.

BELLEVUE, MICH.—The Bellevue Improvement Club has started a movement to secure electricity from the Commonwealth Pwr. Co. and to abandon the municipal electric-light plant.

DETROIT, MICH.—The Ford Motor Car Co. contemplates the installation of a third generator with accessories as soon as the second one, now being installed, is completed. Edward Gray is chief engineer.

DETROIT, MICH.—The Common Council has granted the St. Clair Hotel permission to run electric wires through a conduit now extending across Monroe Avenue, for the purpose of furnishing electricity for lamps and motors to a number of business firms in that section.

GLADWIN, MICH.—The Union Trust Co., of Detroit, has consented to act as trustee under an open mortgage given by the Gladwin Lt. & Pwr. Co. to secure an issue of bonds for improvements and extensions to its system.

GRAND RAPIDS, MICH.—The Central West Improvement Association is advocating an extension of the boulevard lighting system further west on Bridge Street; also to a number of other places.

HARBOR BEACH, MICH.—Announcement has been made by H. B. Ryan, manager and chief owner of the local telephone company, that a new copper circuit will be erected at once. Many other improvements are planned, including the erection of a new line to the southwest, 2½ miles long.

LAPEER, MICH.—Plans are being considered by merchants and residents for the installation of a boulevard lighting system on Nepessing Street to replace the inclosed arc lamps now in use.

MARQUETTE, MICH.—The Michigan State Tel. Co. has been granted authority to purchase the property of the Marquette Tel. Co. for $85,000. Several other mergers in the upper peninsula are proposed.

MILFORD, MICH.—The stockholders of the Milford Home Tel. Co. have purchased the Milford system from the Michigan State Tel. Co. for $7,500. The capital stock of the Milford company has been increased from $15,000 to $30,000.

MUSKEGON, MICH.—The Shaw-Walker Co., which is erecting a four-story addition to its building, is asking for bids for electrical power.

MUSKEGON, MICH.—Improvements are contemplated by the United Home Tel. Co. to its telephone lines in Oceana, Mason and Newaygo Counties, involving an expenditure of about $24,000. Thomas Bromley, Jr., is general manager.

NEW BALTIMORE, MICH.—At a special election held Dec. 23 the proposition to sell the municipal electric-light plant to the Eastern Michigan Edison Co., of Detroit, was defeated.

OVID, MICH.—The City Council is considering the question of abandoning the municipal electric-light plant and entering into a contract with the Commonwealth Pwr. Co., of Jackson, for electrical service. In addition to supplying the village with energy, the company has promised to extend its transmission lines into the country for the benefit of the farmers.

PELLSTON, MICH.—The property of the Pellston El. Lt. & Pwr. Co. was sold Dec. 20 to the Cheboygan El. Lt. Co., of Cheboygan, for $16,100. The Pellston company has been in the receiver's hands for some time.

RICHMOND, MICH.—The Eastern Michigan Edison Co., St. Clair Division, headquarters Mount Clemens, expects to erect within the next three months a 300-kw substation in Richmond, Mich. Equipment for substation and lighting system for Richmond has been ordered. Magnetite arc lamps will be used for street lighting. H. G. Hall is division manager.

SPRING LAKE, MICH.—Plans are being prepared by the Muskegon Interurban Ry. Co. for the erection of a substation in Spring Lake.

ANNANDALE, MINN.—The City Council has granted the Annandale El. Lt. & Pwr. Co. a franchise to install and operate an electric-light plant here.

ST. PETER, MINN.—The town of Kasota, which was formerly supplied with electricity by the municipal electric plant at St. Peter, is now served by the Consumers' Pwr. Co. Owing to the crippled condition of the municipal plant and also to the small boiler capacity, the Consumers' Pwr. Co. will continue to serve Kasota indefinitely.

SHAKOPEE, MINN.—Arrangements have been made whereby the Minneapolis General El. Co. will be permitted to erect high-tension transmission lines through Minneapolis in order to supply electricity for lamps and motors in Shakopee.

VIRGINIA, MINN.—At an election held recently the proposition to issue bonds to take over the water and light plants of the Virginia El. Pwr. & Wtr. Co. was carried. The price to be paid for the property is $452,000 plus the value of recent improvements, which will increase the price to nearly $550,000. It is expected that the city will take over the plants about April 1.

RICH HILL, MO.—The City Council has engaged Rollins & Westover, Midland Building, Kansas City, Mo., to prepare plans and estimates and supervise the construction of the municipal electric-light system in Rock Hill.

WASHINGTON, MO.—The Mississippi Pwr. Distributing Co. has purchased the property of the Tibbe El. Co. and the Franklin Independent Tel. Co., of Washington. Energy for operating the local system will be transmitted from the Keokuk dam.

GREAT FALLS, MONT.—The Great Falls Automatic Tel. Co. has been acquired by the Mountain States Tel. Co. (Bell system) and will be consolidated in the near future. Many improvements are contemplated.

LIBBY, MONT.—The Kootenai Pwr. Co., of Cœur d'Alene, Idaho, is contemplating the construction of a dam and electric power plant here, for which plans are being prepared. Paul D. Pratt, of Libby, is local representative.

SCHUYLER, NEB.—Improvements are contemplated to the municipal electric-light plant within the next 12 months, including the purchase of a 40-kw or 50-kw, 230-volt, three-wire direct-current generating unit, directly connected, and switchboard for same. E. A. Schmid is manager of the municipal electric-light and water-works plant.

TECUMSEH, NEB.—The city has recently enlarged the municipal electric-light plant and water-works. A new 150-hp boiler and shaker grate have been installed and new coal bins built. A new pump has also been installed, a well driven and transmission line erected to same. E. D. Charles is superintendent of water and light plant.

WAYNE, NEB.—The Mayor has been authorized to appoint a committee of five from among the citizens to act with the committee from the City Council in regard to plans for improvements to the municipal electric plant.

CARSON CITY, NEV.—Ira Winters, of Carson City, contemplates the installation of a large electrically driven pumping plant to irrigate his land (1000 acres) on Washoe Lake.

EXETER, N. H.—The Public Service Commission has granted the Exeter & Hampton El. Co. permission to operate an electric system in the town of Stratham.

KEENE, N. H.—The Public Service Commission has granted the petition of the Keene Gas & El. Co. and the Ashuelot Gas & El. Co. for authority to operate an electric system in the town of Westmoreland.

ASBURY PARK, N. J.—Plans are being considered by the Beach Commission for the installation of a new lighting system for the boardwalk and the beach front, to cost about $10,000.

CRANFORD, N. J.—The Barrows-Stewart Co. has been awarded a contract by Thomas Barret to build a concrete dam across the Rahway River at Cranford. The water will be used to drive a turbine to generate electricity for lamps and motors for local use.

KEYPORT, N. J.—An ordinance authorizing the Middlesex & Monmouth El. Lt., Ht. & Pwr. Co. to construct and operate plants in Matawan, Holmdel and Marlboro Township has been approved by the Board of Public Utilities.

YARDVILLE, N. J.—The Public Service El. Co. is planning to install an electric distributing system here.

CLAYTON, N. M.—The municipal electric-light and power plant, which was recently destroyed by fire, is to be rebuilt and equipped with modern machinery.

CARTHAGE, N. Y.—The village of Carthage has entered into a contract with the Carthage El. Lt. & Pwr. Co. for a period of five years. Under the new contract the company is to furnish 46 arc lamps and 16 40-watt tungsten lamps and also 84 60-watt tungsten lamps in the business section of State Street. The 84 lamps for the business district will be placed on ornamental standards. Work will begin on the installation of the ornamental lighting system as soon as possible next spring. The contract provides for placing wires underground on State Street.

MARCELLUS, N. Y.—The Marcellus Ltg. Co. is changing over the local system to utilize Niagara power. The substation and transmission line have been erected and transformers for 25-cycle system purchased. The company expects to purchase a new lighting outfit throughout; tungsten series will be used. F. W. Knapp is interested in the company.

MECHANICSVILLE, N. Y.—The Halfmoon Lt., Ht. & Pwr. Co., of Mechanicsville, is making arrangements to change its generating equipment. At present it is purchasing power from the Adirondack El. Pwr. Corpn., receiving energy at 40 cycles and regenerating at 60 cycles. The company expects to do away with its motor-generator sets and connect up direct to 40 cycles, making its system 40 cycles throughout. On account of this change the company will be obliged to purchase a large amount of equipment, such as motors, transformers, regulators, etc. Appliances of all kinds will be purchased by the company for its showroom, including one power table. W. L. Howland is treasurer and general manager.

NEW YORK, N. Y.—Plans are being considered by the executive committee of the Broadway Association for the installation of a new street-lighting system on Broadway from Twenty-third Street to Times Square. It is proposed to do away with poles altogether and to have lamps suspended from brackets attached to buildings, to be placed at about 20 ft. to 30 ft. apart.

NEW YORK, N. Y.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 25 for three electric passenger elevators in connection with the reconstruction of the United States barge office, New York, in accordance with drawings and specifications, copies of which may be obtained at the above office. Oscar Wenderoth is supervising architect.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Jan. 8 for furnishing materials and installing a complete electric-lighting system in the Church of the Good Shepherd, and for additions to the electrical equipment in the Roman Catholic church at the New York City Home for the Aged and Infirm, Blackwell's Island, N. Y. Blank forms and further information may be obtained at the office of the supervising engineer of the department, foot of East Twenty-sixth Street, New York, where plans and specifications may be seen.

RANDOLPH, N. Y.—The Randolph El. Lt. & Pwr. Co. expects to purchase within the next four months transformers, etc., necessary to provide for day service. The company has recently installed two 150-hp water-tube boilers. J. W. Grace is manager.

ROCHESTER, N. Y.—Plans are being prepared by the Rochester Ry. & Lt. Co. for enlarging the boiler house of its power station 3, located just north of the Platt Street bridge. The plans provide for increasing the boiler capacity by 10,000 hp (12 boilers of 825 hp each) and the installation of automatic underfeed stokers.

ROME, N. Y.—For the purpose of demonstrating the various methods of lighting the business district of the city with ornamental lamps a committee of the Chamber of Commerce and one from the Board of Public Works have secured several different styles of lamps and poles which will be tried out in various parts of the city. The Rome Gas, El. Lt. & Pwr. Co. will erect the lamps and have charge of them.

HAMLET, N. C.—The power plant of the shops of the Seaboard Air Line Ry. Co. in Hamlet was recently destroyed by a boiler explosion.

FINDLAY, OHIO.—The City Council has authorized the lighting committee of the Council to make investigations relative to the establishment of a municipal electric-light plant. The lighting contract with the Toledo, Bowling Green & Southern Trac. Co. will expire Dec. 3, 1913.

XENIA, OHIO—The Public Service Commission has authorized the Dayton Lt. & Pwr. Co., of Dayton, to take over the property of the Xenia Gas & El. Co. The price paid for the plant was $149,750. The Dayton company was also granted permission to issue capital stock to the amount of the sale price.

CUSHING, OKLA.—An electric-light plant is being installed here by H. Askin and Frank Overlees. It is understood that part of the material has been purchased.

INGERSOLL, OKLA.—B. F. Blue, clerk, writes that the town does not propose to install an ornamental street-lighting system as published in these columns in the issue of Dec. 21 but is preparing plans for the erection of a transmission line from Ingersoll to the municipal electric plant in Cherokee, a distance of 4 miles, to secure energy to operate the proposed electric-light system here.

PONCA CITY, OKLA.—The City Council has awarded the contract for erection of pole line, electric machinery, pumping station and installation of system to the Halstead Construction Co., of Phoenix, Ariz., for $5,990, machinery to be supplied by J. Merkle & Co., of Kansas City, at $3,950. When completed the light and water plants, which are owned by the city, will be placed under one management. V. A. Harding, of Kansas City, has been employed as superintendent.

BAKER, ORE.—The Eagle River El. Pwr. Co., of Baker, Ore., may possibly extend its transmission lines 12 or 15 miles to furnish electricity for mining and irrigating work within the next 12 months. J. K. Roming is manager.

HERMISTON, ORE.—The Hermiston Lt. & Pwr. Co. has been granted a franchise to extend its transmission lines into Echo, the work to be completed in 90 days. The company will also furnish electricity in Umatilla at once.

WILLIAMS, ORE.—The Williams Wtr. & El. Co. expects to purchase within the next three months boilers, engines, generators, pumps and condensers, etc. Luther Stover is interested in the company.

FARRELL, PA.—The Farrell Improvement Co. is contemplating the installation of an ornamental street-lighting system on Broadway and Haywood Street. It is proposed to erect ornamental standards carrying cluster lamps. Farrell has not a post office.

FRANKLIN, PA.—The Citizens' Lt. & Pwr. Co., of Johnstown, is contemplating increasing the output of its local power plant.

NEW MILFORD, PA.—The New Milford Lt. & Pwr. Co. expects to erect within the next nine months a new power house and to purchase one or two waterwheels and one waterwheel governor. Charles N. Wood is president and general manager.

WHEATLAND, PA.—The Council has approved the 10-year contract with the Shenango Valley El. Lt. Co., of Sharon, for street lighting at $23 per lamp per year. The company was granted a franchise for commercial lighting in the town.

FORK SHOALS, S. C.—The Cedar Falls Lt. & Pwr. Co. is planning to improve and enlarge its hydroelectric plant here. The wood dam will be replaced by a masonry one and the output of the power plant increased by about 500 hp. The transmission lines will be extended so as to supply electricity to the Kotrine Mfg. Co. in Fork Shoals, also to Fountain Iron, Simpsonville and several other cities. Post office address, Fork Shoals (R. F. D., Fountain Inn, S. C.).

ORANGEBURG, S. C.—The Commissioners of Public Works have requested the City Council to issue bonds to move the municipal electric-light plant to a site on the western outskirts of the city on the Edisto River. The present location has become inadequate for the plant.

ROCK HILL, S. C.—Proposals will be received by the Public Works Commission of the city of Rock Hill until Jan. 21 for the construction of a water-works system. The work will consist of auxiliary and main pumping station, electrically driven pumps, 1,000,000-gal. filter plant and reservoir and about 5 miles of pipe line to the Catawba River. Plans and specifications are on file at the office of the superintendent at Rock Hill, and at the office of Gilbert White, engineer, Charlotte, N. C. Specifications and bidding sheet can be obtained on application to engineer. A complete set of plans will be mailed on receipt of $5 to cover cost. J. B. Johnson is chairman.

LESTERVILLE, S. D.—The Board of Trustees has purchased the electric-light system of the Commercial Club, which will now be owned and operated by the municipality.

BAY CITY, TEX.—Robert McCormick, consulting engineer, of Kansas City, Mo., has been engaged by the Bay City Ice & Lt. Co. to prepare plans for the installation of a new 300-kw steam turbine and complete boiler equipment. The Bay City property recently passed to the control of the Emanuel syndicate, of Dayton, Ohio, which plans other improvements to the ice and electric service. W. C. Duncan is local manager.

BURNET, TEX.—A petition is being circulated asking the City Council to call an election to vote on the proposition to issue bonds for the installation of an electric-light plant, the amount not to exceed $6,000.

HOUSTON, TEX.—The South Texas Trac. Co., recently organized in Houston, will construct an interurban electric railway between points in Harris County. A. E. Hall, C. H. Hall and John A. Woen, of Alvin; H. T. Arnold, of Houston, and Edward P. Allen, of St. Louis, Mo., are interested.

SAN SABA, TEX.—The San Saba El. Lt. Co. has been granted a 50-year franchise by the City Council to install and operate an electric-light plant here.

TEXARKANA, TEX.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 24 for an electric elevator for the United States court house in Texarkana, in accordance with drawings and specifications, copies of which may be obtained at the above office.

SALT LAKE CITY, UTAH.—The Utah Lt. & Ry. Co. has filed an application with the city recorder for an amendment to its franchise permitting it to extend its Warm Springs car line from Seventh North and Second West Streets to the Davis County line. The company contemplates extending the railway to East Bountiful some time this year.

BIG STONE GAP, VA.—The Powell Valley Lt. & Pwr. Co. has recently erected a concrete power house, 32 ft. by 84 ft., and has purchased one 200-kva General Electric generator, one 300-hp Brown Corliss engine and two 150-hp Heine Safety boilers, one General Electric switchboard, complete, and a lighting system, consisting of 50 General Electric luminous arc lamps. J. H. Matthews is secretary and treasurer.

MARION, VA.—The Appalachian Pwr. Co., of Bluefield, W. Va., has purchased a site in Marion on which it proposes to erect a substation, storeroom and office.

PETERSBURG, VA.—The Common Council has awarded the contract for street lighting to the Virginia Ry. & Pwr. Co. of Richmond. The contract is for a period of five years, beginning April 15, and provides for the installation of 40 additional arc lamps on Sycamore Street, between Old and Oak Streets. The company will substitute ornamental poles for the ones now in use.

BUCKLEY, WASH.—The Council has granted P. H. Hebb, of Tacoma, a 50-year franchise to supply electricity in Buckley. Mr. Hebb owns power rights on the White River which he proposes to develop.

RAYMOND, WASH.—The Twin City El. Co. is planning to rebuild its entire lighting system in this city, work on which will begin in the near future. Several new distribution districts are being laid out for the service.

WALLA WALLA, WASH.—C. S. Walters, general manager of the Pacific Lt. & Pwr. Co., states that $150,000 will be expended by the company in this valley for improvements to its system, including the construction of new tracks in Walla Walla and Milton, new cars, paving, reconstruction of substations, freight locomotive, sheds, etc. The company will also build a 10-mile extension to the interurban line out of Vincent, at a cost of about $225,000.

CHARLESTOWN, W. VA.—The property of the Citizens' El. Co., of Charlestown, has been purchased by the Washington City Ry. Co.

BAYFIELD, WIS.—Improvements are contemplated to the municipal electric-light plant within the next six months which will include the purchase of one 120-kw, 60-cycle, 2300-volt alternating-current generator directly connected to high-speed engine; one 60-kw, 60-cycle, 2300-volt belted generator, new switchboard and one motor-driven triplex pump, about 200 gal. per minute capacity. F. M. Herrick is superintendent.

LITTLE CHUTE, WIS.—The Valley Mill & Mercantile Co. contemplates the installation of an electric-light plant.

CODY, WYO.—The Shoshone El. Lt. & Pwr. Co. expects to purchase within the next three months two carloads of Idaho cedar poles and 50 meters. D. A. Tinkcom is superintendent.

RAWLINS, WYO.—The Rawlins El. Lt. & Fuel Co. expects to erect within the next 12 months an elevated coal track to facilitate unloading coal and may possibly purchase a 500-hp surface condenser, 1 ton of wire, 75 meters and a small amount of miscellaneous supplies. Within the next six months the company expects to purchase about 50 ornamental lamp-posts and miscellaneous appliances. J. H. Jacobucci is manager.

NEW WESTMINSTER, B. C., CAN.—The Westminster Pwr. Co., recently organized, proposes to build large storage reservoirs on Brand Creek, Indian River, Young Lake and North Norton Lake, for the purpose of generating electricity to be transmitted to New Westminster, Vancouver and other towns and cities.

VICTORIA, B. C., CAN.—Sealed tenders will be received by W. Galt, city purchasing agent, until Jan. 27 for such general supplies, including cluster-lamp globes, tungsten lamps, carbons, Portland cement, brass goods, hydrants, lead pipe, etc., as may be required by the municipality. Plans and specifications may be obtained at the office of the city purchasing agent.

TRANSCONA, MAN., CAN.—Tenders will be received by P. E. Ryan, secretary of the Commissioners of the National Transcontinental Railway, at Ottawa, until Feb. 13, for furnishing machines, tools, appliances, motors, furnaces, cranes, etc., required for the equipment of the car department shops at Transcona, Man. Specifications may be obtained at the office of W. J. Press, mechanical engineer, Ottawa, Ont.

WINNIPEG, MAN., CAN.—Sealed tenders will be received at the office of M. Peterson, secretary board of control, Winnipeg, Man., addressed to Chairman Board of Control, until Jan. 24, for furnishing and installing in the terminal station three 2700-kw step-down transformers with oil and accessories complete. Plans and specifications may be obtained at the Civic Light and Power Department, 54 King Street, Winnipeg.

BRANTFORD, ONT., CAN.—The city of Brantford is contemplating the installation of an electrically driven pump (10,000,000-gal. capacity) at the water-works pumping station. H. F. Leonard is city clerk.

HAMILTON, ONT., CAN.—The Hydro-Electric Department of the City Council has received authority from the Hydro-Electric Power Commission of Ontario to construct a conduit system for underground wires in Hamilton, to cost $600,000.

PARRY SOUND, ONT., CAN.—A by-law will soon be submitted to the ratepayers asking an appropriation of $5,000 for the installation of a new lighting system. E. E. Armstrong is clerk.

SARNIA, ONT., CAN.—An application has been filed with the Secretary of State at Ottawa for an act to incorporate a railway company under the name of the Huron Lake Shore Ry. Co. to construct and operate an electric railway from Sarnia to Meaford through the counties of Lambton, Bruce and Grey. The company asks for general powers of a railway, including the right to transmit and distribute electricity.

WINDSOR, ONT., CAN.—The City Council has entered into a contract with the Ontario Hydro-Electric Commission for power generated at Niagara Falls to the amount of 2500 hp at $38 per hp per year. The transmission lines are to be erected within 12 months.

WINDSOR, ONT., CAN.—The Windsor & Tecumseh Ry. Co. has been granted permission to build a 10-mile addition to its present system, to cost about $250,000. The proposed line will extend from Tecumseh, the present terminal, to Belle River, and work on it will be started at once.

MONTREAL, QUE., CAN.—The lower house of the Legislature has passed a bill incorporating Mount Royal (the Canadian Northern Railway Company's model city) with an executive franchise of 25 years to the Montreal Tramways Co. and a 15-year exclusive franchise to the Public Service Corpn. to supply electricity for lamps and motors.

WADENA, SASK., CAN.—The contract for installing an electric light and power plant at Wadena has been awarded to the British Columbia Engineering Co., of Winnipeg, Man.

New Industrial Companies

THE CANADIAN FRITCHLE ELECTRIC AUTOMOBILE & BATTERY COMPANY, of Toronto, Ont., Can., has been incorporated with a capital stock of $1,000,000 by G. H. Sedgewick, A. G. Ross and A. E. Langman.

THE ENGLE BATTERY COMPANY OF CANADA, LTD., of Quebec, Que., Can., has been incorporated by L. B. St. Laurent, Hector La Ferte and Antonin Galipeault, all of Quebec. The company is capitalized at $100,000 and proposes to carry on business as electrician, mechanical engineer, manufacturer and dealer in electrical apparatus, etc.

THE FERRANTI ELECTRICAL COMPANY OF CANADA, of Toronto, Ont., Can., has been chartered with a capital stock of $250,000 by A. Gilmour, C. H. Watson and R. B. Henderson.

THE INTERSTATE EQUIPMENT MANUFACTURING COMPANY, of Chicago, Ill., has been incorporated by Henry H. Russell, Joseph W. Fay and Harry C. Kribs. The company is capitalized at $5,000 and proposes to manufacture and deal in electrical supplies and devices.

THE JACKSON EASTERN DISTRIBUTORS, INC., of New York, N. Y., has been incorporated with a capital stock of $10,000 to manufac-

ture engines and motors. The incorporators are: Fred C. Riley, Leo. M. Garahan, John P. Hilands, 2 Rector Street, New York. The company proposes to manufacture and deal in engines and motors.

THE LA FRANCE ELECTRICAL CONSTRUCTION & SUPPLY COMPANY, of Toledo, Ohio, has been incorporated with a capital stock of $10,000 by Otto G. Knigge, Richard W. Kirkley, G. E. Smith and Frank H. Geer.

THE SPLITDORF ELECTRICAL COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture engines, motor generators, batteries, etc. The incorporators are: Carlos W. Curtiss, Oscar J. Rhode and Walter J. Murray.

THE STAR BALL PLAYER COMPANY, of Newark, N. J., has been incorporated by G. A. Swain, of Montclair; G. H. Litterest, of New Brunswick, and F. G. Lake, of Newark. The company is capitalized at $125,000 and proposes to manufacture electrical and other indicators to show scores, records, news, etc.

JOHN WENDT & COMPANY, of Harrisburg, Pa., has been granted a charter with a capital stock of $10,000 for the purpose of dealing in gas and electric fixtures. John Wendt is among the incorporators.

New Incorporations

LITTLE ROCK, ARK.—The Arkansas El. Co. has been incorporated with a capital stock of $20,000. The officers are: C. J. Dolis, president; J. H. Carmichael, vice-president; Nicholas Campbell, secretary and treasurer.

WILMINGTON, DEL.—The Eastern Mexico Pwr. & El. Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000. Herbert E. Latter is among the incorporators.

PORTLAND, MAINE.—The Bellows Falls Pwr. Corpn. has been incorporated with a capital stock of $100,000 to construct and operate plants to generate power for lighting, heating and power purposes. A. F. Jones is president and A. A. Richards treasurer, both of Portland.

ST. LOUIS, MO.—The North Missouri Pwr. Co. has been incorporated with a capital stock of $2,000 to generate and distribute electricity for lamps, heaters and motors. The incorporators are: John S. Lehmann, Harry C. Leehr and Frank H. Nottbusch.

BELVIDERE, N. J.—The Belvidere Delaware El. Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000 to operate electric light and power plants. The incorporators are: S. E. Boardman, H. G. Boardman, of Oxford Township, and J. M. Roseberry, of Belvidere.

NEW YORK, N. Y.—The Inter-Ocean Ry. Co. has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $5,000,000 and proposes to control railway, light, heat and power plants and to do a general transportation business. The incorporators are: Ludwig De Leopold, Paul J. Huesler and Walter E. O. Schaltz, all of New York.

WINGATE, N. C.—The Wingate Tel. Co. has been incorporated with a capital stock of $10,000 by J. W. Bevins and others.

WARREN, OHIO.—The Twentieth Century El. Ltg. Co. has been incorporated with a capital stock of $30,000 by Jay Buchwalter, G. W. Phelps, C. C. Chaffee, H. S. Shaw and M. A. Hood.

PITTSBURGH, PA.—The Baden El. Co. has been incorporated with a capital stock of $5,000 by H. F. Kates, of Pittsburgh; H. C. Denison and W. A. Weiland, of Bellevue.

SCRANTON, PA.—The Ry., Lt., Ht. & Pwr. Co. has been granted a charter with a capital stock of $10,000. The incorporators are: Frank J. Pryor, Jr.; Joseph M. Welsh and W. J. Mulholland, of Scranton.

SEWARD, PA.—The Seward El. Co. has been incorporated with a capital stock of $5,000 by J. W. Blough, H. E. Thompson and R. C. Saylor, all of Johnstown.

SNYDER, TEX.—The Snyder Ice & Lt. Co. has been incorporated with a capital stock of $25,000 by E. W. Clark and others.

GREEN SPRING DEPOT, VA.—The Watauga & Green Spring Tel. Co. has been incorporated with a capital stock of $5,000. The officers are: W. T. McConnell, president; J. D. McChesney, vice-president, and Guy McConnell, secretary, of Abingdon, Va.

ABBOTSFORD, WIS.—Articles of incorporation have been filed for the Abbotsford El. Co. with a capital stock of $10,000 by G. H. Baker, A. J. Young, F. A. Jackson, H. J. Campbell, F. B. Wing and J. A. Billings.

Trade Publications

ELECTRIC RADIATORS.—Luminous "Aston" radiators form the subject of Publication No. 710, a copiously illustrated four-page folder on this product of Veritys, Limited, 28 King Street, Covent Garden, London, W. C., England.

GAS-GENERATING SYSTEM.—Bulletin No. 106 of the Power & Mining Machinery Company, Milwaukee, Wis., refers to the Loomis-Pettibone gas-generating system, illustrates and describes the operating characteristics of this system, and also shows pictures of a number of plants in which the system has been installed.

FUEL ECONOMIZERS.—The Green Fuel Economizer Company, Matteawan, N. Y., is issuing a forty-eight-page condensed catalog of its products. It is No. 145 and is entitled "What We Make." It refers briefly to standard and special fuel economizers, coverings for fuel economizers, mechanical-draft outfits, heating, ventilating and drying outfits, motor-driven and engine-driven fans, propeller fans, vertical and horizontal engines and other apparatus.

MODERN ILLUMINATION.—An attractive pamphlet with a cover bearing the title "Modern Illumination" has been issued by the Bryan-Marsh Electric Works of the General Electric Company. In it an effort is made to bring out some of the more important advantages of electric lighting as applied to shops, public buildings, offices, streets, etc. A chart is given to show that in workshops the rate of accidents during the month of December is nearly twice as great as during the month of July, owing to the lack of proper illumination. The booklet contains much information, presented in non-technical language, of interest to the wide public concerned in the question of correct illumination.

WOOD PRESERVATION.—"Some Facts About Treating Railroad Ties" is the title of a treatise by Mr. W. F. Goltra, recently published by the W. F. Goltra Tie Company, Cleveland, Ohio, of which the author is president. The results of many years of experience, study and research in this important subject are embodied in this pamphlet. Part I gives comprehensive descriptions of the various processes of wood preservation that are at present in use—the Bethell, Burnet, Rutgers and others. Part II is devoted to recent improved methods of treating ties and timbers which are the result of extended research and experience on the part of the author. The treatise carries out its suggestive title, in that facts are dealt with and not theories. The little book contains a number of articles that have appeared in the technical press, contributed by Mr. Goltra and others, in which the subject matter is considered from all angles. Valuable tables showing weight of ties, absorption of oil, a lay-out of a tie-preserving plant for treatment by the Goltra process and other diagrams of interest are given. The treatise is copyrighted. It is bound with heavy paper covers, contains 110 pages and costs $1 per copy.

Business Notes

THE FEDERAL SIGN SYSTEM (ELECTRIC) has moved its general sales offices from the Home Insurance Building to its new factory building at Lake and Desplaines Streets, Chicago, Ill.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, New York City, has removed its electrical supply business from 436 West Broadway to 76 West Thirty-sixth Street, where larger quarters have been provided.

THE AUTOMATIC VENTILATOR COMPANY announces that Mr. H. E. Lavelle, formerly with the Standard Paint Company, will be its selling and mechanical representative in the Middle Western States shortly after the first of the year. Mr. Lavelle will make Indianapolis his headquarters.

THE GOULDS MANUFACTURING COMPANY, Seneca Falls, N. Y., announces that the Mine & Smelter Supply Company, Denver, Col., has been appointed agent for the Goulds line of triplex pumps. The territory will include the entire State of Colorado and adjacent counties in the States of Wyoming, New Mexico, South Dakota and Montana.

THE W. K. PALMER COMPANY, engineer, Kansas City, Mo., announces the removal of its offices from quarters occupied for the past eight and one-half years to 919 Baltimore Street, where increased facilities for engineering business in the lines of its specialties are available. The company requests bulletins and catalogs of manufacturers of lines of equipment in civil, mechanical and electrical engineering fields.

THE WIRE INSPECTION BUREAU of New York, through its secretary, Mr. H. T. Wreaks, reports a continually increasing demand for special inspection, tests and general engineering work on railway signal, fire-alarm and electric-light installations from railroads such as the Lackawanna, Missouri Pacific, Chicago, Milwaukee & St. Paul, Great Northern, Chicago & Western Indiana, from municipalities, especially those operating under the commission form of government, and from fire marshals' officers of various states; also, a similarly increasing demand for general inspection work by independent organizations on all kinds of electrical and transmission machinery and apparatus and rubber goods.

THE INDEPENDENT ELECTRIC MANUFACTURING COMPANY, Milwaukee, Wis., has completed a new factory and moved all the equipment and stock into the new quarters. The building is located on the south side of Milwaukee and is said to be one of the most complete and up-to-date factories for the manufacture of starting and controlling devices in the country. Special attention has been paid to the experimental and test rooms, the test room being equipped with motor-generator sets so that variations of direct-current voltage may be obtained for testing direct-current apparatus, and transformers have been installed for the different alternating-current voltages. The property on which the factory is built is located on the Kinnickinnic River, making it possible to ship and receive by water, as well as rail when necessary.

Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 29 West 39th St., New York. Meeting, second Friday of each month, October-May.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Holberton, Pacific Gas & Elec. Co., San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Annual meeting, Syracuse, N. Y., Jan. 21, 1913.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive Committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Annual convention, Buffalo, N. Y., Feb. 11-13.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRICAL VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Meeting, fourth Tuesday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, W. E. Holmes, 46 Blackstone St., Boston, Mass. Meetings monthly upon notice.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General Secretary, P. S. Millar, Enginering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 120 South Meridian St., Indianapolis, Ind.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Meeting, first Monday of each month.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next meeting at Berlin in 1913.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Annual convention, Waterloo, April 23-24, 1913. Secretary, H. B. Maynard, Waterloo, Ia

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, April, 1913, Waterloo, Ia.

JOVIAN ORDER. Jupiter (president), F. E. Watts, Western Electric Co., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, E. F. Strong, Chaska, Minn. Sixth annual convention, March 15-22, 1913.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, P. W. Markham, Brookfield, Mo. Next convention at Mexico, Mo., 1913.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Indianapolis, Ind., May 27-29, 1913.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederick P. Vose 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Chicago, May, 1913.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. H. Carlton, General Electric Company, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-treasurer, M. H. Hendle, Augusta, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss. Annual meeting, Natchez, April 21-23.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Seattle, Wash., Sept. 10-12.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, Farley Osgood, Public Service Electric Company, Newark, N. J.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass. Next biennial meeting, New York, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND ELECTRIC DEVELOPMENT ASSOCIATION. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Company, Albany, N. Y.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, H. H. McKinney, Next annual meeting, Duluth, Minn., Jan. 7-8.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Columbus, Jan. 21.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Kilkenny, St. John's, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

PITTSBURGH ELECTRICAL BOOSTER CLUB. Recording Watt, George H. Criss, 1806 Union Bank Building, Pittsburgh, Pa. Meeting, first Monday each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. E. Rosenberg, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Secretary, Philip S. Dodd, 29 West 39th Street, New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTHWESTERN GAS AND ELECTRIC ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, Tex., May 21-24.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Convention, St. Louis, Mo., Jan. 28-30, 1913.

WESTERN SOCIETY OF ENGINEERS. Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August. Annual meeting, Tuesday after Jan. 1 each year.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 24, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,047,917. RAILWAY SIGNALING SYSTEM; C. J. Coleman, New York, N. Y. App. filed July 10, 1908. Automatic signals for steam or electric roads.

1,047,935. SWITCH HANDLE; M. Guett, Hartford, Conn. App. filed June 7, 1911. Rotary porcelain handle for snap switch.

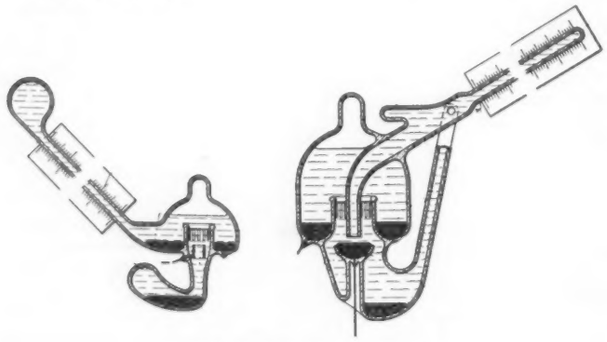
1,047,954. MAGNETIC LIFTING APPLIANCE; G. Kröhne, Duisburg, Germany. App. filed Jan. 22, 1912. Plurality of linked magnets for lifting irregular bodies.

1,047,955. MEANS FOR REGULATING POLYPHASE COMMUTATOR MACHINES; J. L. LaCour, Vesterås, Sweden. App. filed Nov. 11, 1908. Special windings and adjustable transformers.

1,047,956. SYSTEM FOR AMPLIFYING ELECTRIC CURRENT VARIATIONS; C. D. Lindridge, Providence, R. I. App. filed Nov. 17, 1911. Negative and variable resistances for telephone transmission.

1,048,001. ATTACHMENT PLUG OR THE LIKE; J. C. Smith, Oak Park, Ill. App. filed March 29, 1911. Screw-shell anchorage and insulation.

1,048,003. MEANS FOR REGULATING ELECTRIC LAMPS; H. S. Stone, Boston, Mass. App. filed Jan. 21, 1911. Hand device for dentists, oculists, etc.



1,048,156.—Electrolytic Meter.

1,048,006. DYNAMO-ELECTRIC MACHINE; M. E. Thompson, Ridgway, Pa. App. filed June 23, 1910. Improvement on patent No. 591,024 to avoid leakage flux.

1,048,034. CONDENSER ARRANGEMENT; A. R. Bullock, Cleveland, Ohio. App. filed March 20, 1911. Series parallel.

1,048,066. GUARD FOR OVERHEAD TROLLEY WIRES; A. Gergely, Milwaukee, Wis. App. filed Aug. 9, 1912. Horizontally swinging lapped fingers constituting emergency supports.

1,048,119. ELECTRIC SWITCH; J. E. Wood, Dalton, Mass. App. filed Jan. 3, 1912. Lever switch with lock for automobiles, etc.

1,048,144. METALLURGICAL FURNACE; C. H. Fulton and W. A. Coursen, Rapid City, S. D. App. filed July 7, 1911. Cylindrical resistance type.

1,048,156. ELECTROLYTIC METER; H. S. Hatfield, Jena, Germany. App. filed May 9, 1911. Special measuring vessel filled by tilting the meter.

1,048,164. TROLLEY POLE; E. A. Hornbostel, Jr., Des Moines, Ia. App. filed April 18, 1906. Locked in case of derailment.

1,048,167. KEY SOCKET; H. Hubbell, Bridgeport, Conn. App. filed June 17, 1911. Contacts inclosed in two-piece porcelain.

1,048,168. KEY SOCKET; H. Hubbell, Bridgeport, Conn. App. filed Oct. 3, 1911. Mechanism carried by one part of a two-piece base.

1,048,172. ELECTRICAL SWITCHING AND TESTING DEVICE; M. R. Hutchison, Bronxville, N. Y. App. filed Oct. 21, 1905. Self-contained hand device.

1,048,176. TROLLEY AND SWITCH; T. P. Knowland, Jeffersonville, Ind. App. filed Dec. 28, 1908. Switching and replacing device.

1,048,200. ELECTRICAL SIGNALING SYSTEM; W. Noble, St. Louis, Mo. App. filed July 16, 1909. Contact-controlling mechanism for selective telegraphy, etc.

1,048,209. TELEGRAPH REPEATER; G. L. Rawdon, Cleveland, Ohio. App. filed Jan. 2, 1912. Time relay. Improvement on patent No. 914,877.

1,048,223. ELECTROMAGNETIC SEPARATOR; H. Stein, Cologne, Germany. App. filed Nov. 28, 1908. Serrated pole extensions.

1,048,231. METHOD OF MANUFACTURING CARBORUNDUM FILAMENTS; F. C. Thoms, Pittsburgh, Pa. App. filed Dec. 4, 1909. A carbon core is flashed in a vapor of silicon tetrachloride, hydrogen and ethylene.

1,048,253. TELEPHONE TRANSMITTER; D. H. Wilson, Chicago, Ill. App. filed Dec. 30, 1904. Two opposing diaphragms.

1,048,260. TROLLEY GUARD; G. Zeller, Issaquah, Wash. App. filed May 29, 1912. Retaining clamp.

1,048,277. THERMOSTAT; D. E. Belden, Auburn, N. Y. App. filed June 29, 1911. With temperature-adjustment feature for regulating house temperature, etc.

1,048,279. LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed April 19, 1912. Retaining device.

1,048,314. TROLLEY HEAD; O. N. Iverson, Hills, Minn. App. filed April 23, 1912. Tension and replacing device.

1,048,349. TEMPERATURE ALARM; C. F. Rumold, J. P. Faulkner and J. W. Dinsmore, Berea, Ky. App. filed June 30, 1911. Induction coil and permanent magnet.

1,048,366. ELECTROMAGNETIC SWITCH; J. C. Smith, Louisville, Ky. App. filed July 31, 1911. Brake and arc extinction.

1,048,390. INSULATOR; F. Brown, Laketon, Mich. App. filed Sept. 9, 1911. Two-part conical pin type.

1,048,394. DEVICE FOR CLOSING OR CAPPING VESSELS AND SIMILAR ARTICLES; M. Dickinson, Brighton, England. App. filed Aug. 2, 1912. Disinfecting telephone transmitter device.

1,048,419. CONTROLLER; A. J. Loguin, West Allis, Wis. App. filed March 27, 1911. Protective starting device.

1,048,424. FLUID PRESSURE GOVERNOR; J. F. Menningen, West Allis, Wis. App. filed May 20, 1909. Quick make-and-break switch.

1,048,432. MOTOR-CONTROL SYSTEM; J. C. Smith, Louisville, Ky. App. filed July 31, 1911. Dynamic braking.

1,048,436. ELECTRIC CURRENT TRANSFORMER; E. C. Westcott, Sacramento, Cal. App. filed Dec. 4, 1911. Closed tank containing oil-submerged winding.

1,048,439. ELECTRICALLY ACTUATED RAILWAY SWITCH; J. H. Baker, Henderson, Ill. App. filed Oct. 31, 1910. May be thrown from a signal station, engine cab or car, or manually.

1,048,443. TELEPHONY OR TELEGRAPHY; S. G. Brown, London, England. App. filed Dec. 28, 1908. Amplifying signals.

1,048,450. CURRENT-CONTROLLING APPARATUS; E. L. Gale, Sr., Yonkers, N. Y. App. filed May 1, 1905. Automatic starting and stopping of elevators, etc.